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Clock works

DIGITAL TV TESTING SOLUTIONS

For digital TV programmers, OEM, IC vendors, operators and service providers

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COMPANY

RT-RK is an R&D company with 300+ engineers specialized in DTV technology, with cutting edge infrastructure, and in operations since 1991.

The company is sharing revenue equally from engineering services, integration of own IP blocks, and sales of products.

Investment in own R&D activities is the essential path to growth, while close interaction with stable and diverse customer base ensures timely identification of market trends and needs.

Giving rise to the importance of thorough systematic testing of own products, the company has founded a QA department specialized in system testing methodologies.

The accomplishments in the field of statistical and functional testing, and in algorithms for video quality assessment have been confirmed in numerous papers on scientific and commercial conferences.

With time the company's QA has grown to the extent where its services can be offered to customers, in:

- Organizing QA activities
- Building Test Environment
- Defining Tests strategy
- Designing/Building Test Procedures
- Designing/Building Tests

The test tools in use are diverse ranging from

- Own proprietary system BBT to
- Proprietary Software module/unit Test tool
- Open source tools
- Linux Test Project, Dejagnu, Valgrind.

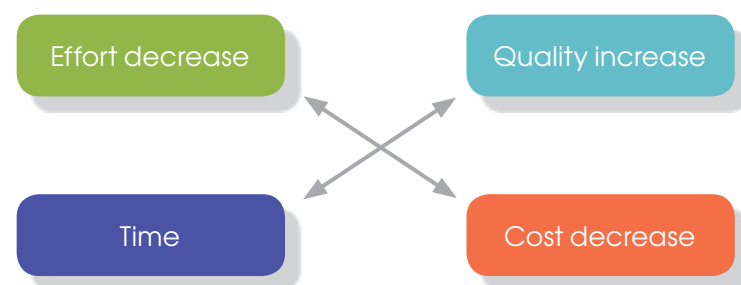
The company offers its services through two business models

- Service based
- Product based model (sales of predefined packages).

The company's market proven solutions have served silicon vendors: Cirrus Logic, Trident, CSR, SMARDTV, consumer electronics customers: Kathrein, General Satellite, TESC Kudelski, Vestel, and operators T-Mobil and Telenet.

Motivation – Requirements of the market

- Accelerate time to market
- Shorter software-life-cycle
- Software releases within a shorter period of time
- Growing of software complexity
- Growing of hardware complexity
- Frequent changes of software requirements within a product's development cycle



WHY BBT?

- Starting from a strong background in software development
- Help engineers in development of reliable and stable software
- Provide test systems for R&D, but also for use in QA departments (IC manufacturers and broadcasters) and production lines (OEM)
- Automated testing tool controls all the components of a test environment (generators, modulators, etc.), a device under test using shell interfaces (JTAG, RS232, LAN, USB), and analyzes output AV signals without any human interaction
- Every single step of the test process is logged and finally the system delivers detailed easy to review results, on demand
- Automated tests provide confidence about the stability, reliability and performance of consumer devices (STB, iDTV, mobile phones, etc.)
- Decision-makers need hard facts and a real proof that a device under test is mature enough for the market
- Possibility to use in-house test equipment, support for more than 50 different physical and logical devices
 - Platform control (JTAG probe: Lauterbach, Ashling, etc.), I2C control devices, GPIO controlled devices, RS232 communication, LAN communication, Power Switch, etc.)
 - Pattern generators (Fluke, QuantumData, Astro, Shibasoku, etc.)
 - Modulators (DekTec (DVB, ATSC), Alifronika, Rohde&Schwartz: SFQ, SFU, etc.)
 - Grabber devices (analogue AV, digital AV, LVDS up to 240Hz)
 - Audio analysis (Audio Precision, DigitalDolby multi channel decoders, audio cards)
 - Logical devices (Picture/Audio compare algorithms, loggers, file out, message box, etc.)
 - RC emulator devices (support for different RC protocols, RF4CE support, ZigBee RC support, etc.)Open easily extendable platform
 - Highly modular software with clear hierarchical organization
 - Fully transparent to the front application
 - Available SDK for future upgrade (documentation, binaries and source example)
- Open easily extendable platform
 - Highly modular software with clear hierarchical organization
 - Fully transparent to the front application
 - Available SDK for future upgrade (documentation, binaries and source example)
- Support for Python script language

- Test creation from Graphical User Interface
- Easy transfer of already prepared test cases to another platform
- Different types of test reports customizable according to customer needs (logging of all results and data to database, web based reports, Excel/Word based reports)



WHAT WE DO

System functional test (black box)

- Testing of an entire system against functional requirements.

Unit integration and regression test (white/gray box)

- Checking of modules (units) interaction and bug fixes

System performance test

- Testing of non-functional requirements of a system

System acceptance test

- Set of tests which software must pass before accepted by a client

Picture quality metrics

- Real Time A/V assessment in terms of MPEG and broadcasting artifacts (blocking, packet loss, lip-sync, blurring, frizzling, image absence, etc.)

Pre-certification testing

- Nordig, CI-CAMs certification

Hardware



RT-AV140
Embedded picture quality measurement



RT-AV400
TV set black box testing using a chamber



RT-AV150
Portable automated STB test system



RT-AV100/101
Network attached Audio/Video capture device



RT-AV110
Standalone test station



RT-AV300
All in one for hardware-in-the-loop testing

Software



RT-Executor
SW framework for test creation, test plan creation and automatic test execution



INTENT+
Test Management and Test Execution framework, Requirements vs Test Plan matrix formalized, reusability of tests through product's life cycle, and different product models

Test Suites



RT-TS-STB-F
Automated test environment for functional STB testing



RT-TS-STB-RR
Multi STB testing using round robin method



RT-TS-STB-S
STB stress testing



RT-TS-STB-DS
STB diagnostic station



RT-TS-STB-P
STB production line test suite



RT-TS-IDTV
Integrated digital television functional test suite

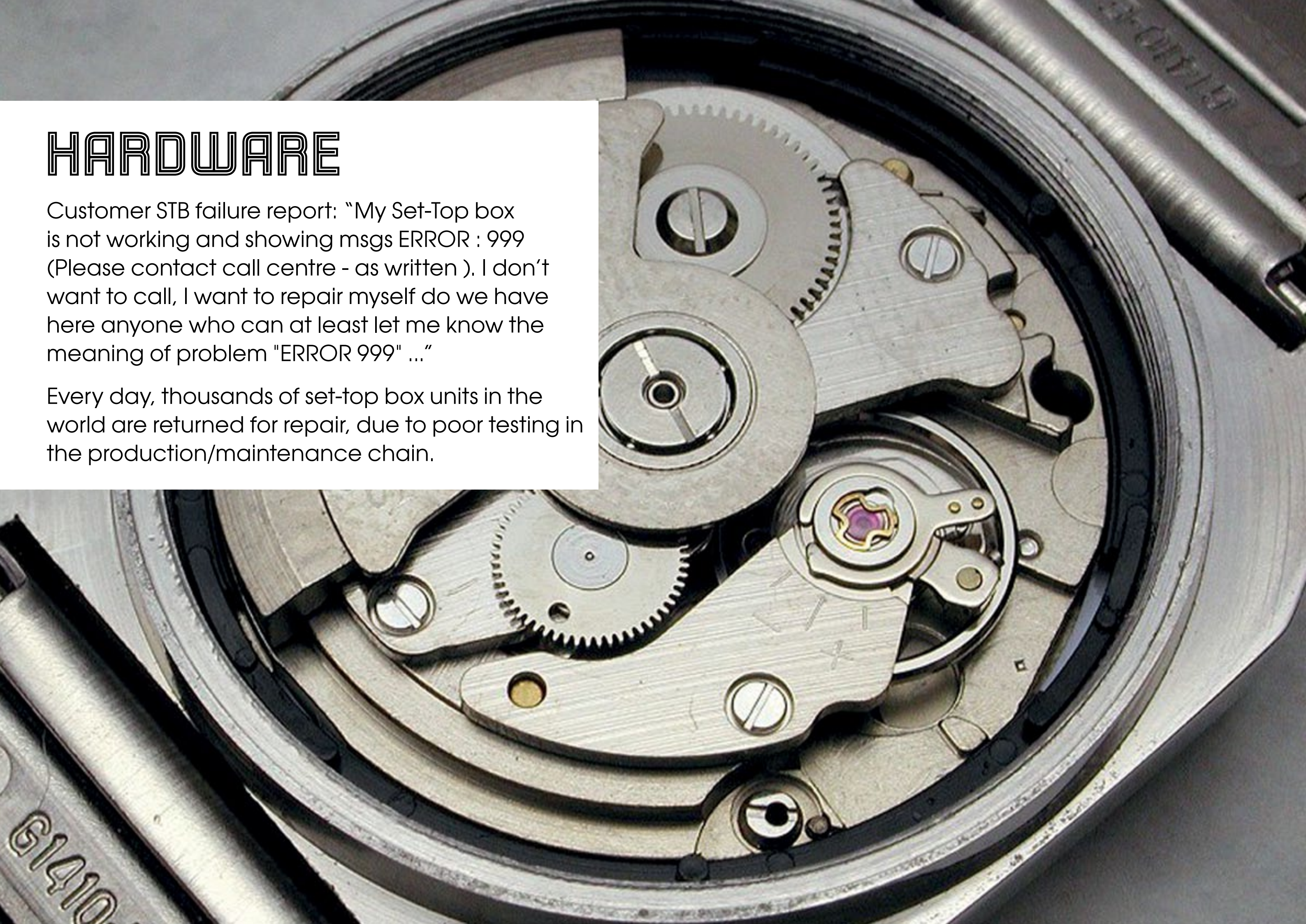


RT-TS-BBA
Baseband audio test suite

HARDWARE

Customer STB failure report: "My Set-Top box is not working and showing msgs ERROR : 999 (Please contact call centre - as written). I don't want to call, I want to repair myself do we have here anyone who can at least let me know the meaning of problem "ERROR 999" ..."

Every day, thousands of set-top box units in the world are returned for repair, due to poor testing in the production/maintenance chain.



Network attached Audio/Video capture device



RT-AV100/101 is a device for real-time capturing and streaming of audio and video signals up to 1080p60 over 1Gbit/s LAN. The device is intended for head-end monitoring and for STB/DVD/Blu-ray testing.

Input interfaces

- Capture of SD, ED and HD video content up to 1080p60
- Variety of digital or analog A/V sources (SDI, HDMI, YPbPr, S-video, composite, S/PDIF-COAX and S/PDIF-OPT)
- On-the-fly real time lossless compression up to 1080i60 video streaming
- Capture of digital or analog audio
- Measurement of electrical values:
 - LNB Voltage
 - Analog Video signal level
 - Analog Audio signal level
 - SCART interface (pin8/pin16)
- Measurement of LNB frequency
- Support and compliance with consumer and professional audio and video standards
- Allows easy image capture or video streaming of multiple A/V signals into single computing server
- Automatic video signal and standard detection

Use cases

- Ideal for verification of STB/DVD devices in the phase of development
- Monitoring of broadcast systems over LAN network
- Blu-ray testing
- Multiple devices' testing using round robin or parallel method



Connectors



LNB in/out: F-type connector



Analog Audio Input: Stereo audio on 3.5mm TRS jack



Multi A/V input: 26 pin MDR (Mini Delta Ribbon) connector – Component, S-Video, SCART



Composite video



2X HDMI input: Type A



S/PDIF coaxial (RCA)



S/PDIF optical (TOSLINK)



Ethernet



2.5mm stereo jack for remote controller

Features

- Real time capture and lossless compression of SD, ED and HD video content of up to 1080p60 from digital and analog A/V sources (HDMI, YPbPr, S-video and composite)
- Automatic video signal and standard detection
- Captures and stores images or video sequences to internal memory for on-device image processing
- Live preview through LAN interface
- Transfers grabbed images/video to PC for future analysis
- Captured content can be sent to more than one client – multicast
- Allows easy image capture or video streaming of multiple A/V signals into single computing server which can be spatially dislocated from video source
- Capture of digital or analog audio for 48 kHz with 24-bit resolution
- Sampling of analog video, audio and control signals of up to 32MBPS for measurement of amplitude and temporal characteristics of signal
- Support and compliance with consumer and professional A/V standards
- DSP based platform which is capable to execute desired processing or analysis algorithm on captured audio and video content.
- Gigabit Ethernet connectivity allows (with on-the-fly compression) up to 1080i60 video streaming
- Utilization of existing network infrastructure
- Configuration and firmware update through LAN interface
- Easy installation procedure
- RT-AV101 - 1U 19-inch rack-mount device
- Voltage and frequency measurement on Audio/Video inputs (CVBS, RGB, Line In, LNB etc.)
- Embedded remote controller emulator
- Predefined API for device control from third party application
- Microsoft Windows XP/7 and Linux operating system supported

INTERFACES	
Digital Video Input	HDMI, SDI
Analog Video Input	Composite, Component, S-Video, SCART
Supported HD Format	720p50, 720p59.94, 720p60, 1080PsF23.98, 1080p23.98, 1080PsF24, 1080p24, 1080PsF25, 1080p25, 1080PsF29.97, 1080p29.97, 1080PsF30, 1080p30, 1080i50, 1080i59.94, 1080i60, 1080p50 and 1080p60
Supported SDI formats	HD and SD SDI Receiver, with complete SMPTE Video and Audio Processing, as per SMPTE 425M, 292M and SMPTE 259M-C
Supported SD Format	625/25 PAL, 525/29.97 NTSC and 525/23.98 NTSC
HDMI Compliance	HDMI 1.3
Multiple Rate support	SDI, HDMI and component analog video connections are switchable between SD and HD. SDI switches between 270 Mb/s standard definition SDI and 1.5 Gb/s HD-SDI
Video Sampling	4:2:2
Color Precision	10 bit
Color Space	4:2:2 YUV
Digital Audio Input	S/PDIF (optical/coaxial), HDMI
Analog Audio Input	<ul style="list-style-type: none">• ADC - stereo system input and output (Stereo Audio, 24-bit, 96kHz, Multi-bit Sigma Delta ADC and Stereo 24-bit, 192kHz, Multibit Sigma Delta DAC)• Multi channel I2S standard 4 signals interface (in and out)
HDMI Audio Input	<ul style="list-style-type: none">• Dolby Digital and DTS• IEC60958 or IEC61937 compatible
LNB In/Out	F Connector with loop through
LAN	1000BASE-T Ethernet
EXTRAS	
Operation modes	PC controlled
System monitoring	PC application
Power supply	<ul style="list-style-type: none">• Power supply integrated in platform cover with passive cooling• 110-240V 10W per channel
OS Compatibility	Windows XP SP3, Windows 7, Windows 8
Dimensions	267 x 220 x 47mm (single RT-AV100 unit)
PROCESSING	
Video processing	<ul style="list-style-type: none">• Lossless video compression (1:3),• Real time video scaling for live video preview

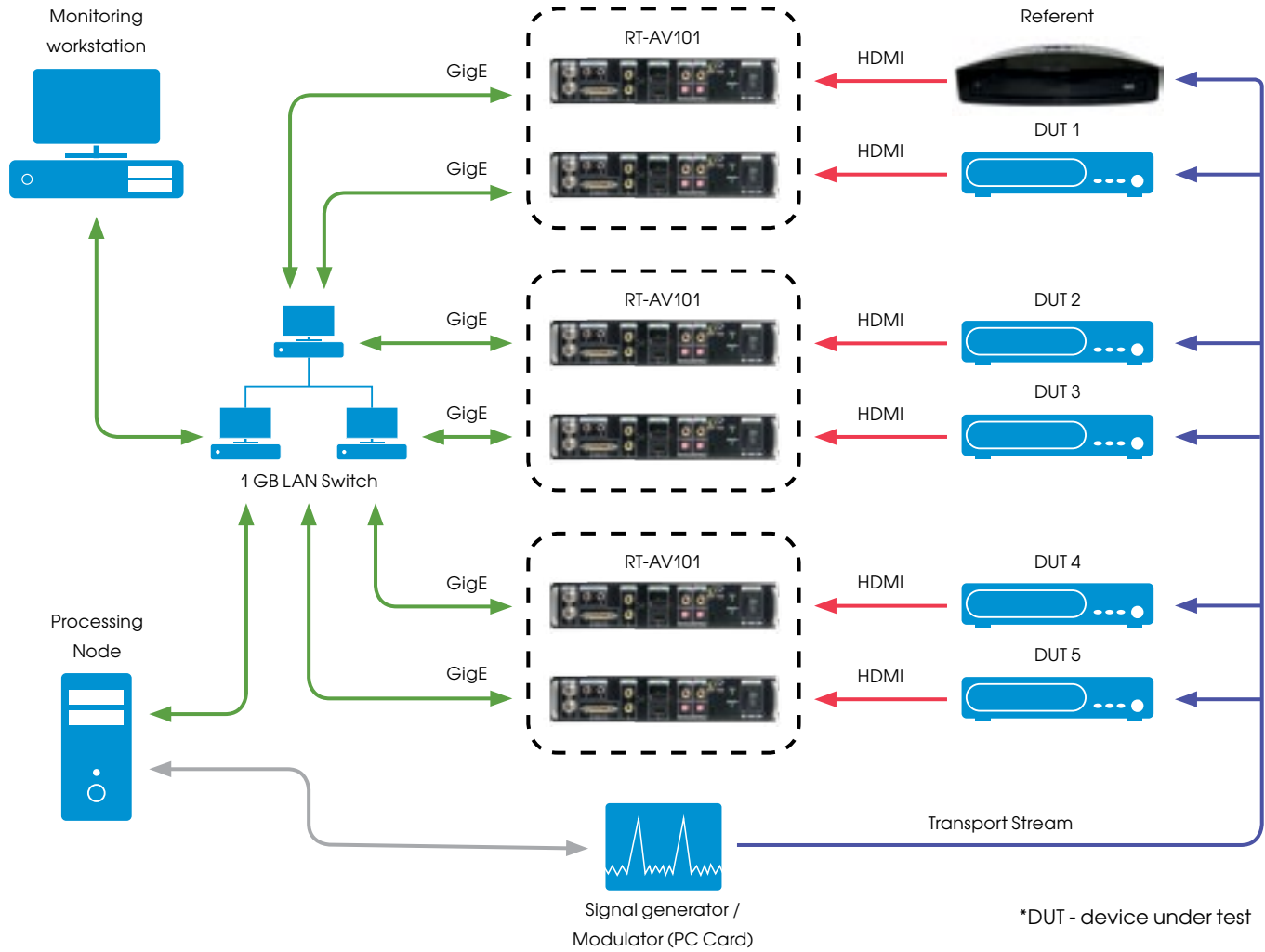
Optional

Variety of usage

- Audio/Video capture device
- Automatic systems for multimedia devices verification and testing processes
- Automatic systems for video quality assessments

Easy connectivity

- Gigabit Ethernet connectivity
- Captured content can be sent to more than one client - multicast
- Configuration and firmware update through LAN interface
- Easy installation procedure



PC utility

- Controls grabber device
- Transfers grabbed images/video and recorded audio files to PC
- Test scenario execution - automatic (compares currently grabbed output with reference picture and sound, and decides upon given criteria whether the test has passed)

Package content

- RT-AV100/101 device
- Control software (Utility application or RT-Executor) or device driver (single DLL with API interface for using device in customer application)
- CD with utilities and documentation
- Cables (HDMI, component, CVBS, LAN, power)

Software

RT-AV100/101 control application

- Connects with device by static IP address
- Selects parameters for video grabbing (interface, resolution, signal type)
- Communicates with device via adequate commands
- Activates grabber functionality
- Saves captured snapshots and audio files
- Enables live preview functionality

- Device driver (single DLL with API interface), binary
 - Demo software (usage of DLL), source code MSVS2005
 - Stand-alone PC application* for controlling RT-AV100/101 device with included device driver
 - BBT Test Application* with included device driver
- *optional

Standalone test station



RT-AV110 is a standalone test station for audio and video signal acquisition from set-top box. Real-time capturing and processing of audio and video signals up to 1080p60 over 1Gbit/s LAN. System is comprised of a processing unit and RT-AV100 AV grabber device. System is intended for STB/DVD/Blu-ray testing, head-end monitoring and testing on final production (assembly) line.

Input interfaces

- Capture of SD, ED and HD video content up to 1080p60
- Wide variety of digital or analog A/V sources (SDI, HDMI, YPbPr, S-video and composite, S/PDIF coaxial, S/PDIF optical)
- On-the fly real time lossless compression up to 1080i60 and video streaming
- Capture of digital or analog audio
- Measurement of electrical values:
 - LNB Voltage
 - Analog Video signal level
 - Analog Audio signal level
 - SCART interface (pin8/pin16)
- Measurement of LNB frequency
- Support and compliance with consumer and professional audio and video standards
- Allows easy image capture or video streaming of multiple A/V signals into single computing server
- Automatic video signal and standard detection

Use cases

- Ideal for testing of devices on the production line
- Monitoring of broadcast systems over LAN network



Connectors

- 

LNB in/out: F-type connector
- 

Analog Audio Input: Stereo audio on 3.5mm TRS jack
- 

Multi A/V input: 26 pin MDR (Mini Delta Ribbon) connector – Component, S-Video, SCART
- 

Composite video RCA
- 

2X HDMI input: Type A
- 

S/PDIF coaxial RCA
- 

S/PDIF optical TOSLINK
- 

Ethernet
- 

2.5mm stereo jack for remote controller

Features

- Stand alone test station with possibilities to work in network environment
- Real time capture of SD, ED and HD video content up to 1080p60 from wide variety of digital or analog A/V sources
- Voltage measurement of STB video output
- Captures and stores images or video sequences to internal memory for on device image processing
- Live preview
- Transfers grabbed images/video to processing unit for further analysis
- Automatic video signal and Standard Detection
- Capture of digital or analog audio up to 48 kHz with 24-bit resolution
- Support and compliance with consumer and professional A/V standards
- DSP based platform which is capable of executing desired processing or analysis algorithm on captured audio and video content.
- Gigabit Ethernet connectivity allows (with on-the-fly compression) up to 1080i60 video streaming
- Utilization of existing network infrastructure
- Configuration and firmware update through LAN interface
- Easy installation procedure
- RT-AV110 - 2U 19-inch rack-mount device

Variety of usage

- Audio/Video capture device
- Automatic systems for multimedia devices verification and testing processes
- Automatic systems for video quality assessments



INTERFACES	
Digital Video Input	HDMI, SDI
Analog Video Input	YPbPr, Component, NTSC, PAL or S-Video
Supported HD Format	720p50, 720p59.94, 720p60, 1080PsF23.98, 1080p23.98, 1080PsF24, 1080p24, 1080PsF25, 1080p25, 1080PsF29.97, 1080p29.97, 1080PsF30, 1080p30, 1080i50, 1080i59.94, 1080i60, 1080p50 and 1080p60
Supported SDI formats	HD and SD SDI Receiver, with complete SMPTE Video and Audio Processing, as per SMPTE 425M, 292M and SMPTE 259M-C
Supported SD Format	625/25 PAL, 525/29.97 NTSC and 525/23.98 NTSC
HDMI Compliance	HDMI 1.3
Multiple Rate support	SDI, HDMI and component analog video connections are switchable between SD and HD. SDI switches between 270 Mb/s standard definition SDI and 1.5 Gb/s HD-SDI
Video Sampling	4:2:2
Color Precision	10 bit
Color Space	4:2:2 YUV
Digital audio Input	HDMI, S/PDIF (optical/coaxial)
Analog Audio Input	<ul style="list-style-type: none">• ADC/DAC - stereo system input and output (Stereo Audio, 24-bit, 96kHz, Multi-bit Sigma Delta ADC and Stereo 24-bit, 192kHz, Multibit Sigma Delta DAC),• Multi channel I2S standard 4 signals interface (in and out)
HDMI Audio Input	<ul style="list-style-type: none">• Dolby Digital and DTS• IEC60958 or IEC61937 compatible
LNB In/Out	F Connector with loop through
LAN	1000BASE-T Ethernet
EXTRAS	
Operation modes	PC controlled
System monitoring	PC application
Power supply	Power supply integrated in platform cover 120-240V
OS Compatibility	Windows XP SP3; Windows 7 32bit
Dimensions	2U 19 " rack device



PC utility

Testing Solution - RT-Executor

- Controls grabber device
- Transfers grabbed images/video and recorded audio files to a PC
- Test scenario execution - automatic (compares currently grabbed output with reference picture and sound, and decides upon given criteria whether the test has passed)

Testing Solution - INTENT+

- INTENT+ is test management and test execution software intended to track the quality assurance trough the project lifetime

RT-AV110 control application

- Connects with device by static IP address
- Selects parameters for video grabbing (interface, resolution, signal type)
- Sends appropriate message to device
- Activates grabber function
- Saves captured snapshots and audio files
- Enables live preview functionality

Package content

- RT-AV110 device
- CD with utilities and documentation
- Control software (Utility application or RT-Executor Application)
- Cables (HDMI, LAN, power and custom made multi AV input cable)

Software

- Stand-alone PC application for controlling RT-AV110 device with included device driver
- RT-Executor with included device driver

Embedded picture quality measurement



RT-AV140 is EmbeddedPQM (Picture Quality Measurement) test device (for one node: one input set HDMI+CVBS) for STB (set-top box) artifact detection. RT-AV140 is aimed at deployment in non-referent systems for detection of blocking, packet Loss, and black screen artifacts. It enables real-time capturing and processing of audio and video signals up to 1080p30 (1080i60). Test results are available over network using Simple Network Management Protocol (SNMP). RT-AV140 is a 19" rack device with integrated grabber and processing unit.

System description

Head-end

- SDI capture of SD and HD video content up to 1080i60

Terminal

- Video grabbing capabilities: SD (CVBS) and HD (HDMI) signals up to 1080i60
- On-the fly real time lossless compression up to 1080i60 and video streaming
- No reference video quality assessment
- Processing is done inside device and results are sent over LAN
- Automatic video signal and standard detection



Use cases

- Video quality assessment of broadcasting signal
- Quality assessment of multi-media devices
- DTV back-end quality assessment
- STB video output quality assessment
- Detection of up-scaled SD material to HD (blurring measurement)
- Detection of the bad deinterlacer temporal processing (field offset detection)

Artifact detection

Packet loss and **blocking** artifact detection related to error in signal transportation media or MPEG2 compression.



Packet loss



Blocking

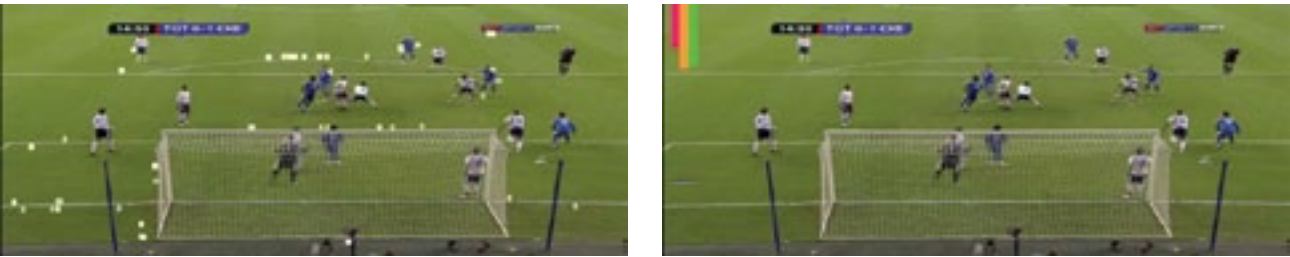
Image absence which is defined as zero temporal activity and zero spatial activity for a specified period of time when a known moving video output should be present.



Blurring which is defined as a loss of image sharpness on a static image which persists for a specified number of video frames.



Ringing which is defined as a high frequency noise near edges.

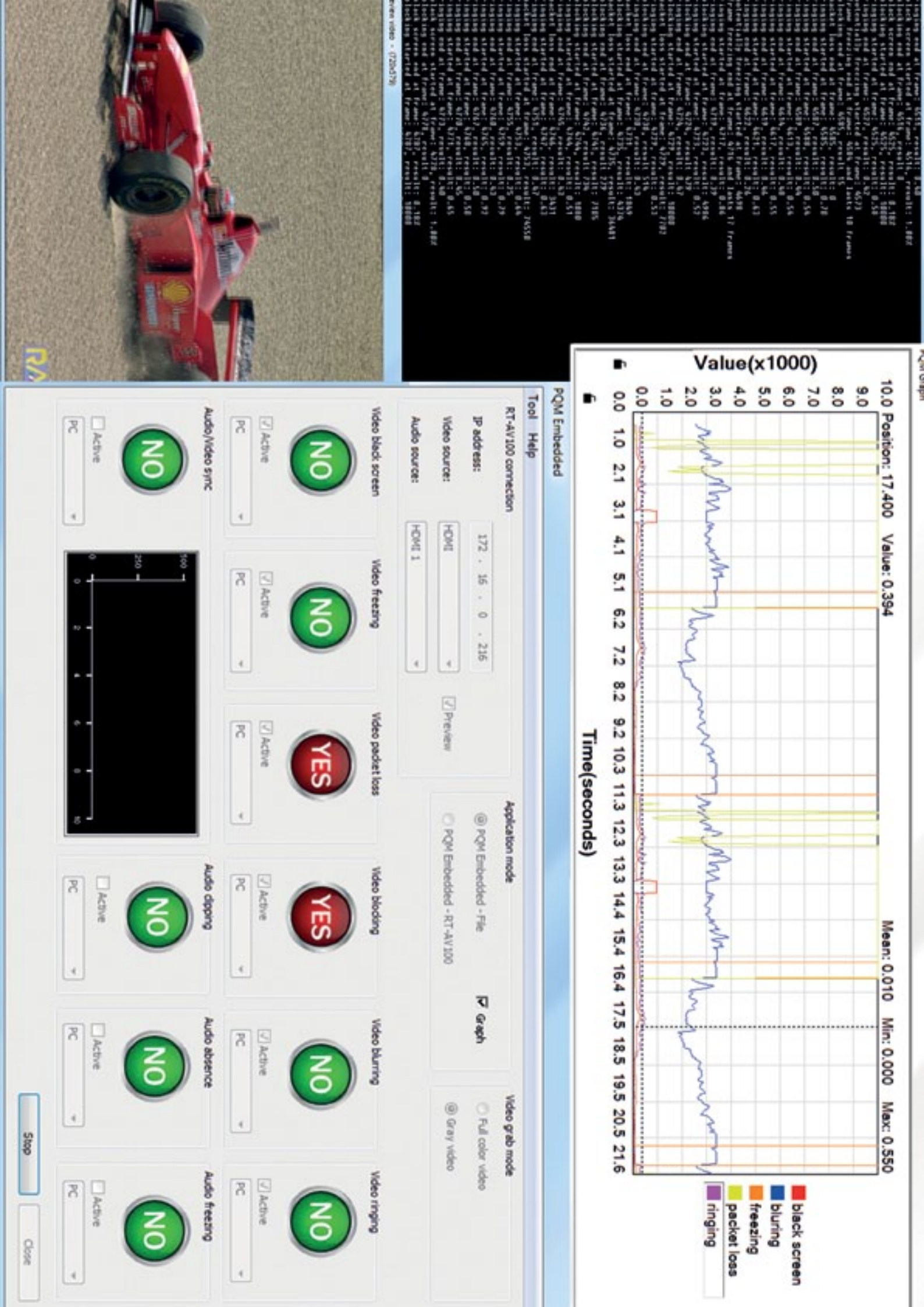
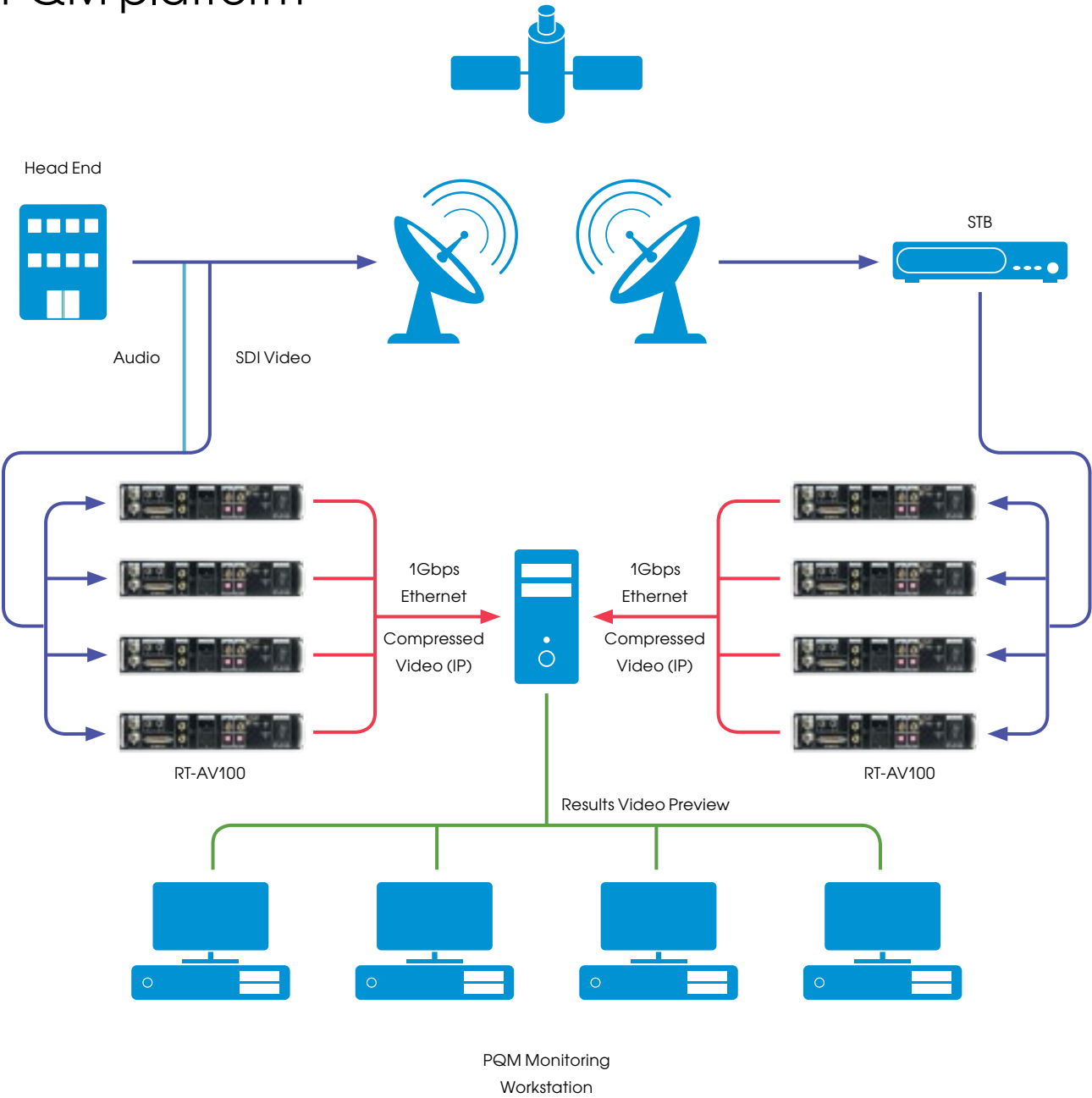


RT-AV140

Field loss which is defined as "interlace-like" artifacts.



PQM platform



Portable automated STB test system



Field Test system RT-AV150 is a portable automated STB test system intended for use in consumer homes for verification of an individual unit functionality. Typical deployments are in field service vehicle. It equips technicians with a powerful tool which performs basic functionality tests in order to diagnose possible malfunctions of customer’s device.

Input interfaces

- Capture of SD, ED and HD video content up to 1080p60
- Wide variety of digital or analog A/V sources (SDI, HDMI, YPbPr, S-video and composite)
- On-the fly real time lossless compression up to 1080i60 video streaming
- Capture of digital or analog audio
- Measurement of electrical values:
 - LNB Voltage
 - Analog AV signal level
 - SCART Interface (pin8/pin16)
- Measurement of LNB frequency
- Support and compliance with consumer and professional audio and video standards
- Allows easy image capture or video streaming of multiple A/V signals into single computing server
- Automatic video signal and standard detection

Use cases

- Ideal for verification of STB/DVD/Blu-ray players devices in customer’s homes or retailers offices
- Monitoring of head-end signal quality in broadcast systems




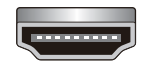
Connectors

- 


LNB (RF) in/out: F-type connector
- 

Analog Audio Input: Stereo audio on 3.5mm TRS jack
- 


Multi A/V input: 26 pin MDR (Mini Delta Ribbon) connector – Component, S-Video, SCART
- 


2X Composite video
- 

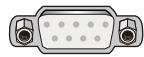
2X HDMI input: Type A
- 

S/PDIF coaxial (RCA)
- 

S/PDIF optical (TOSLINK)
- 

Ethernet
- 

2.5mm stereo jack for remote controller
- 

USB Mini B connector
- 

RS232 male DE-5 connector

Features

- Real time capture of SD, ED and HD video content up to 1080p60 from wide variety of digital or analog A/V sources (HDMI, YPbPr, S-Video and composite)
- Automatic video signal and standard detection
- Captures and stores images or video sequences to internal memory for on device image processing
- Live preview through LAN interface
- Transfers grabbed images/video to host device (Tablet) for future analyzes
- Allows easy image capture or video streaming of multiple A/V signals into single computing server which can be spatially dislocated from video source
- Capture of digital or analog audio for 48 kHz with 24-bit resolution
- Sampling of analog video, audio and control signals up to 32MBPS for measurement of amplitude and temporal characteristics of signal
- Support and compliance with consumer and professional A/V standards
- DSP based platform which is capable to execute desired processing or analysis algorithm on captured audio and video content.
- Gigabit Ethernet connectivity allows (with on-the-fly compression) up to 1080i60 video streaming
- Voltage and frequency measurement on A/V inputs (CVBS, RGB, Line In, LNB etc.)
- Embedded remote control emulator

INTERFACES	
Digital Video Input	HDMI, SDI
Analogue Video Input	Composite, Component, S-Video, SCART
Supported HD Format	720p50, 720p59.94, 720p60, 1080PsF23.98, 1080p23.98, 1080PsF24, 1080p24, 1080PsF25, 1080p25, 1080PsF29.97, 1080p29.97, 1080PsF30, 1080p30, 1080i50, 1080i59.94, 1080i60, 1080p50 and 1080p60
Supported SDI Formats	HD and SD SDI Receiver, with complete SMPTE Video and Audio Processing, as per SMPTE 425M, 292M and SMPTE 259M-C
Supported SD Formats	625/25 PAL, 525/29.97 NTSC and 525/23.98 NTSC
HDMI Compliance	HDMI 1.3
Multiple Rate Support	SDI, HDMI and component analogue video connections are switchable between SD and HD. SDI switches between 270 Mb/s standard definition SDI and 1.5 Gb/s HD-SDI
Video Sampling	4:2:2
Color Precision	10 bit
Color Space	4:2:2 YUV
HDMI Audio Input	<ul style="list-style-type: none">S/PDIF PCM, Dolby Digital and DTSIEC60958 or IEC61937 compatible
Analogue Audio Input	<ul style="list-style-type: none">ADC - stereo system input and output (Stereo Audio, 24-bit, 96kHz, Multi-bit Sigma Delta ADC and Stereo 24-bit, 192kHz, Multi-bit Sigma Delta DAC),Multi-channel I2S standard 4 signals interface (in and out)S/PDIF
LAN	1000BASE-T Ethernet
EXTRAS	
Operation mode	Standalone Device
System monitoring	PC application
Power supply	External 120W AC1005, 120-240V ~3A, Output 19V 6.3A, Power cord extender
Dimensions	38cmx28cmx10.5cm
Housing	Carrying case w/o carrying strap (55cmx50cmx17cm)
Optional equipment	Printer (report printer - Citizen CTS281), Bar Code scanner, Signal level meter
PROCESSING	
Video processing	<ul style="list-style-type: none">Lossless video compression (1:3)Real time video scaling for live video preview

 Optional

PC utility

- Testing Solution – RT-Executor Home Screen**
- Database login and identification of a device via barcode
 - Possibility of selection of different test scenarios
 - Supported testing devices overview
 - Automatic test scenario execution
 - Storing of results into database

RT-AV150 control application

- Selects parameters for video grabbing (interface, resolution, signal type)
- Activates grabber function
- Saves captured snapshots and audio files
- Enables live preview functionality

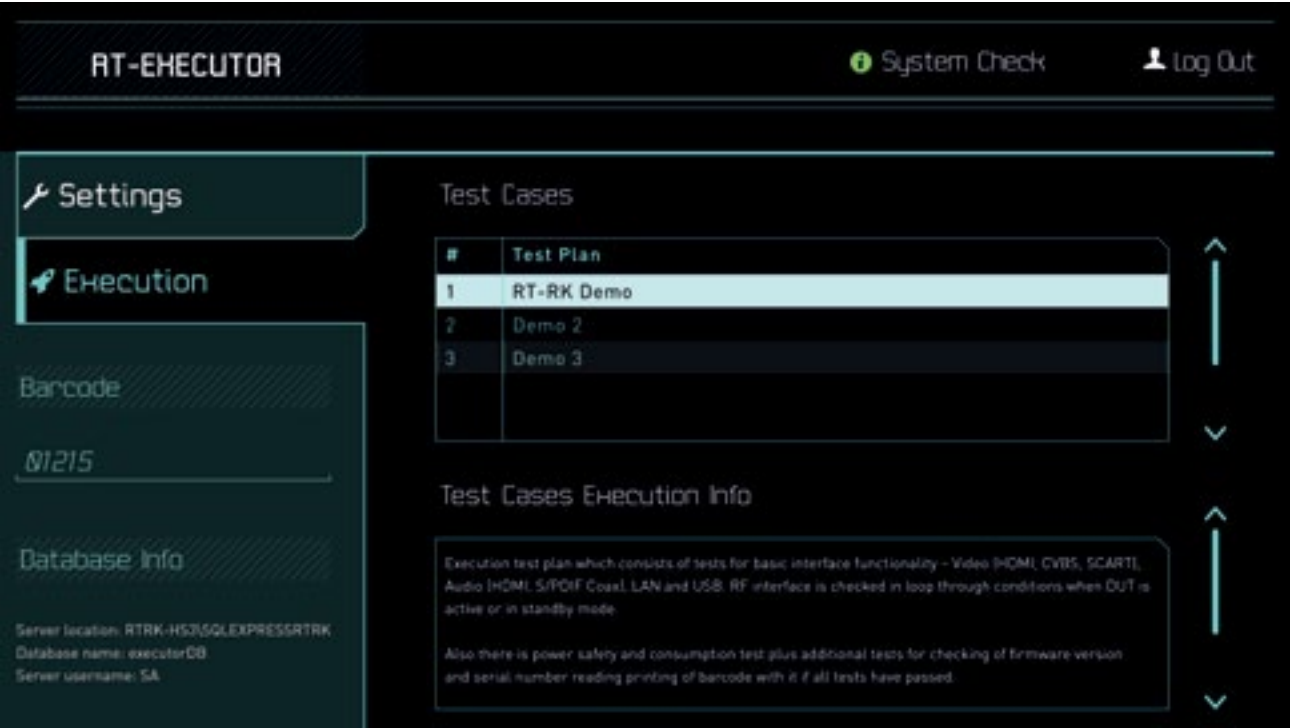


Package content

- Carrying case w/o carrying strap
 - RT-AV150 Home Screen device
 - Power cord extender
 - Mini printer*
 - Bar code scanner*
 - Signal Level Meter*
 - CD with utilities and documentation
 - Control SW (Utility application)
 - Cables (HDMI, S/PDIF, LAN, CVBS, Multi AV input cable) and adapters (RCA to stereo Jack 3.5mm)
- *Optional

Software

- Standalone application for manual controlling of device under testing
- RT-Executor Home Screen application



All in one for hardware-in-the-loop testing



RT-AV300 is intended for consumer device testing: iDTV, STB, DVD and Blu-ray. It can be used both as an Audio/Video signal generator and real time SD/HD video signal capture device at the same time. RT-AV300 provides an extended feature for use in all stages of multimedia product verification and test process.

Flexible input interfaces

Video

- LVDS grabbing 1, 2 and 4 channels up to 120Hz
- HDMI 1.3 grabbing up to 1080p60
- CVBS grabbing

Audio

- Digital (S/PDIF COAX/ OPT, HDMI)
- Analog stereo up to 48kHz/16bit

Most relevant output interfaces

Video

- HDMI 1.3 up to 1080p60
- VGA up to 1440x900@75Hz
- YPbPr up to 1080i60
- CVBS/S-Video NTSC and PAL

Audio

- Analog stereo up to 48kHz/16bit
- Digital Audio Interface (HDMI)48kHz/16bit

Remote access/control

- 1Gbit Ethernet interface
- Fully controlled over Ethernet connection
- Parallel access from multiple user location

Use cases

- Hardware system for automated testing of AV and multimedia devices in consumer electronics
- Replacing the whole set of generators and grabber devices



Connectors



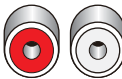
HDMI: Type A receptacle HDMI out x 2



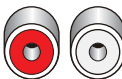
Composite NTSC/PAL input



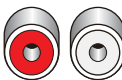
Composite NTSC/PAL output



AUX Input



Stereo audio output x2



Stereo audio input



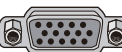
Component video output



Subwoofer output



S/PDIF coaxial input



VGA output



S-Video on 4-pin mini-DIN connector

Features

- Operation modes:
 - Generator mode
 - Grabber mode
 - Generator/Grabber dual mode
- Generates static video on selected output using custom patterns
- Generates audio output using custom patterns
- It is alternative to a whole group of devices used for multimedia testing
- SD card slot for custom Audio/Video pattern storage
- Gigabit ethernet connection
- Supports remote control emulator features
- Fully controlled by PC application
- Easy firmware update using ethernet connection
- Live preview on PC side (640x480)
- RT-AV101 - 1U 19-inch rack-mount device



SCART connectors (if additional audio inputs/outputs are required they can be accessed via provided SCART adapter)



S/PDIF optical TOSLINK



RJ-45 LAN connector



SD card slot



HDMI: Type A receptacle HDMI in



LVDS: MOLEX WM7914CT-ND

INTERFACES

Video Grabber	<ul style="list-style-type: none">Digital: LVDS, HDMIAnalog: CVBS
Video Generator	<ul style="list-style-type: none">Digital: HDMIAnalog: YPbPr, RGB, S-Video, CVBS, VGA
Audio Grabber	<ul style="list-style-type: none">Digital: HDMI, S/PDIF-COAX, S/PDIF-OPTAnalog: TV RC, Line In, headphones TRS, SCART1, SCART2, subwoofer
Audio Generator	<ul style="list-style-type: none">Digital: HDMI AudioAnalog: Line Out (RC + SCART2), TV out (RC + SCART1)
Remote Control	Configurable RC output support
Memory Extension	SD card slot

SUPPORTED FORMATS

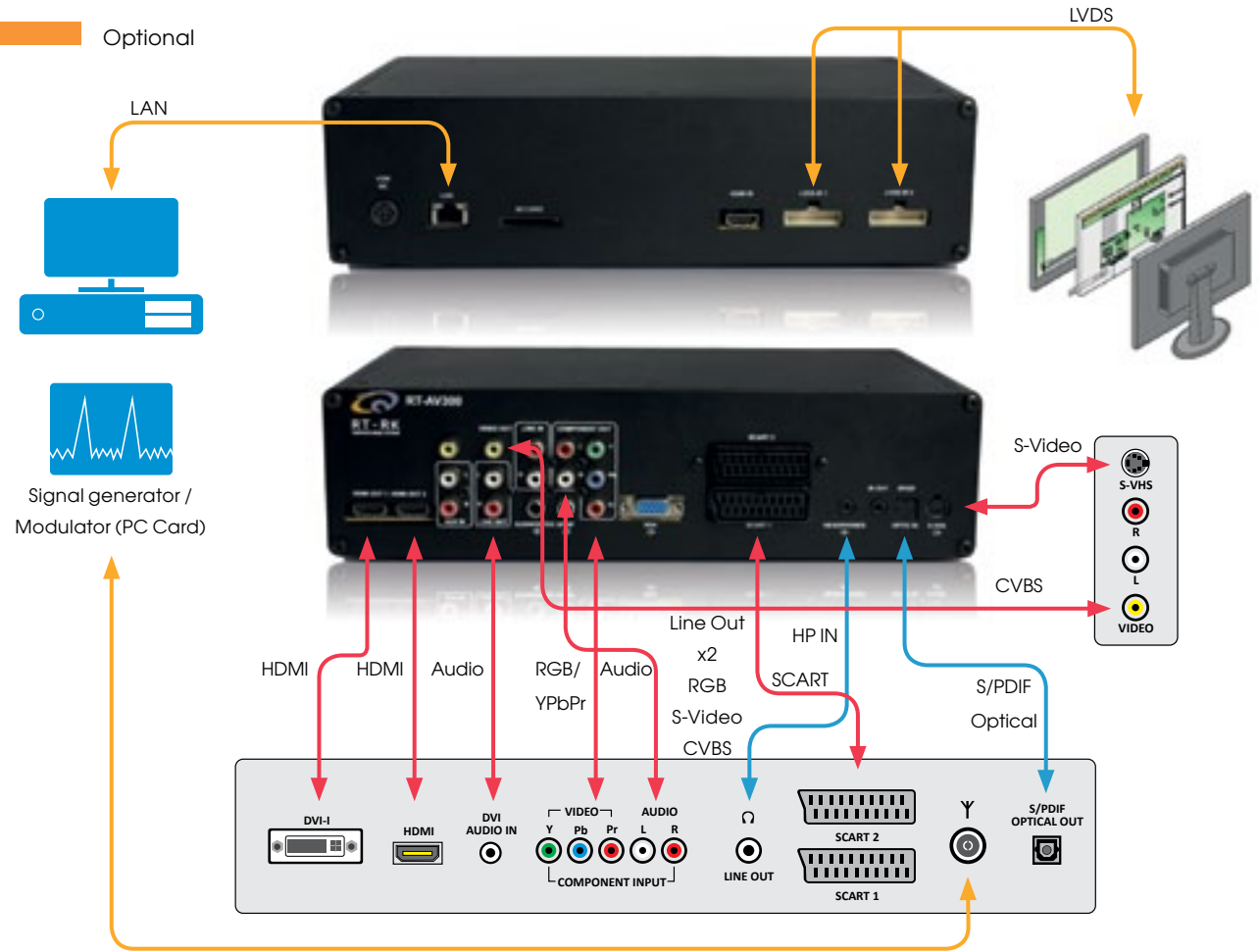
Video Grabber	LVDS	6, 8, 10 and 12 bits over 1, 2 and 4 channel (VESA, JEIDA, FP data formats) up to Full HD (1920x1080) with 120 pictures per second
	HDMI	480i60, 576i50, 480p (640x480) 50Hz, 480p (720x480) 60Hz, 576p, 720p, 1080i, 1080p30, 1080p50, 1080p60
	HDMI Compliance	HDMI 1.3 (with HDCP 1.1)
	CVBS	625/25 PAL, 525/29.97 NTSC
Video Generator	HDMI	480i60, 480p60, 576i50, 576p50, 720p50, 720p60, 1080i50, 1080p24, 1080p25, 1080p30, 1080p50, 1080p60
	YPbPr	480i60, 480p60, 576i50, 576p50, 720p50, 720p60, 1080i50, 1080i60
	CVBS	480i60, 576i50
	SCART1	<ul style="list-style-type: none">CVBS: 480i60, 576i50RGB: 480i60, 480p60, 576i50, 576p50, 720p50, 720p60, 1080i50, 1080i60
Audio Grabber	SCART2 (CVBS and S-Video)	480i 60Hz, 576i 50Hz
	VGA	640x350 85Hz, 640x400 70Hz, 640x400 85Hz, 640x480 60Hz, 640x480 72Hz, 640x480 75Hz, 720x400 70Hz, 720x400 85Hz, 800x600 56Hz, 800x600 60Hz, 800x600 72Hz, 800x600 75Hz, 1024x768 60Hz, 1024x768 70Hz, 1024x768 5Hz, 1152x864 85Hz, 1152x864 60Hz, 1152x864 70Hz, 1280x1024 60Hz, 1280x1024 75Hz, 1280x768 60Hz, 1360x768 60Hz, 1440x900 60Hz, 1440x900 75Hz
	HDMI Audio, S/PDIF-COAX, S/PDIF-OPT, TV RC, Line In, headphones TRS, SCART1, SCART2, subwoofer	2 channels up to 48 kHz of 16 bits
Audio Generator	HDMI Audio, Line Out (RC + SCART2), TV out (RC + SCART1)	2 channels up to 48 kHz of 16 bits

EHTRAS

Operation modes	<ul style="list-style-type: none">Stand alonePC controlled
System monitoring	PC application
Power supply	<ul style="list-style-type: none">Power supply integrated in platform cover with passive cooling12V DC power input
OS Compatibility	Microsoft Windows XP SP3, Windows 7, Windows 8
Dimensions	306x158x80mm

PROCESSING

HD Down Conversion Real time video scaling for video preview – over LAN



PC utility

- RT-Executor - Testing Solution**
- Controls device operation mode (generator, grabber or dual mode)
 - Transfers grabbed images/video and recorded audio files to a PC
 - Test scenario execution - automatic (compares currently grabbed output with reference picture and sound, and decides upon given criteria whether the test has passed)

RT-AV300 control application

- Connects to the device with static IP address
- Selects grabber and generator (interface, resolution, type of signal, pattern) and sends an appropriate message to RT-AV300 device
- Sends pattern for generating static video
- Activates grabber and generator functions
- Saves captured snapshots and audio files
- Enables live preview functionality

Package content

- RT-AV300 device
- Power brick 110V-220V AC, 12DC out
- Cables (LVDS, HDMI, CVBS, Component, LAN)
- CD with utilities and documentation

Software

- Device driver (single DLL with API interface), binary
- Demo software (usage of DLL), source code MS-VS2005
- Stand alone PC application for control RT-AV300 device (with included device driver)
- RT-Executor application with included device driver

TV set black box testing using a chamber



RT-AV400 is an integrated framework for fully automated TV testing using optical inspection of TV screen. It is a camera based solution; functional verification of device under test is based on captured image analysis. RT-AV400 is constructed as a black chamber in order to have invariant light conditions. It is easily configured and customized for a wide range of electronic devices: TV, mobile phones, game consoles, tablets.



System description

- PC based technology
- Performs TV set functional verification and TV display verification
- Control of input signal devices (generators)
- Analog: RF Signal, CVBS, RGB-VGA, DVI, HDMI
- Digital: MPEG2 TS, Modulators (DVB-T, DVB-C, DVB-S)
- Control of infrared RC emulator device
- Control of signal capture device (camera)

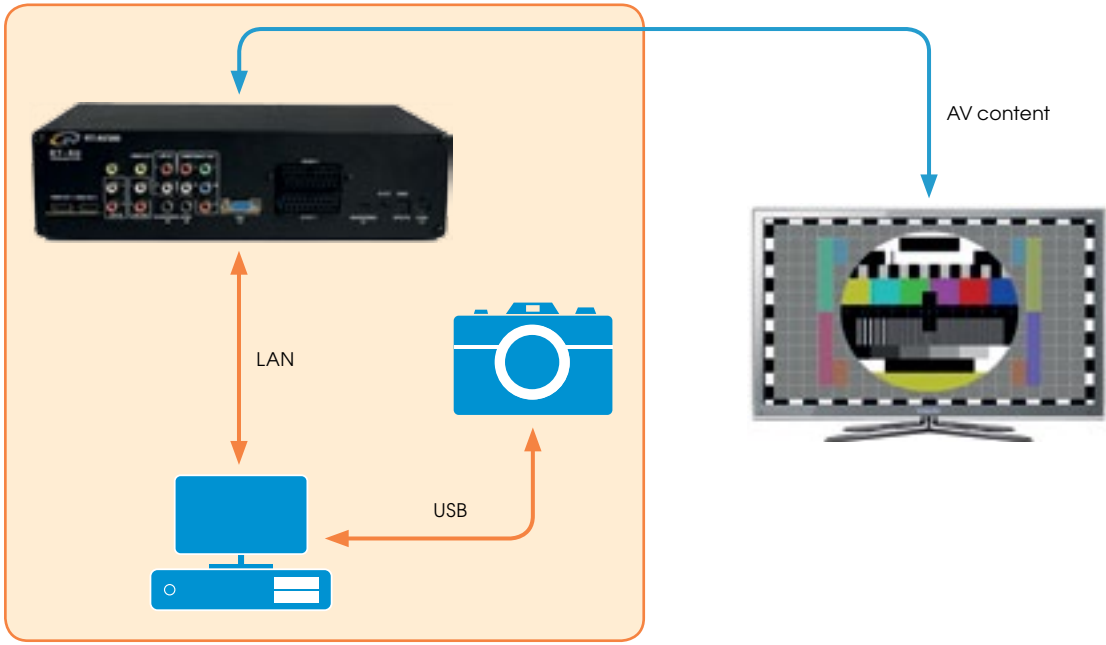
Features

- Defect detection
- Color verification
- Pattern matching
- High-accuracy measurements
- Image analysis
- Presence/absence detection
- Optical character recognition
- No electrical interaction with system
- Independent from technology: LCD, PLASMA, LED
- Independent from the screen size: 19 to 52 inches
- Independent from aspect ratio: 16:9/16:10/4:3

Use cases

- Product verification on the final production line
- Functional testing
- Large scale and regression testing

Connecting scheme



Optical character recognition

- Selection of region of interest
- New font adaptation
- Font color selection
- Background color selection

Package

- RT-AV400 system
- RT-Executor application with necessary device drivers (devices control modules: for camera, signal generators, RC controller, algorithms, etc)
- Camera
- Remote controller emulator
- Installation service - integration of system at customer location
- Writing customer specific device drivers (optional)
- CD with utilities and documentation

Screen capture ← Region of interest ↔ Recognized text



- TV-gids
- TV-theek
- Mijn opnames
- Telenet TV-shop
- Communicatie
- Extra
- Instellingen
- Info & Help

Touch panel devices test system



RT-AV500 TouchPro is the ultimate solution for testing mobile devices with touch panels (tablets, mobile phones...). TouchPro provides unique approach without moving parts during tests execution. It supports devices up to 10.1", and supports devices with different OS (Android, iOS and Windows).

Features

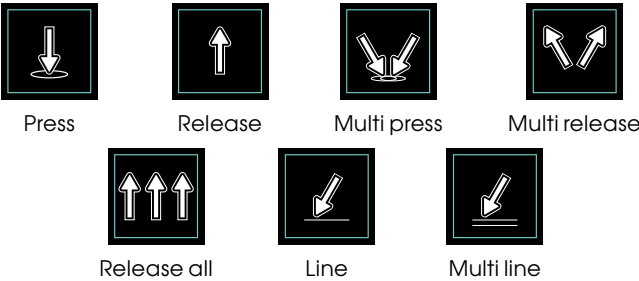
- Allows testing of fully assembled devices
- It stimulates touchscreen with the conductive pads matrix (Matrix size 21X14 enables 42 lines and 28 columns for 10.1" screen)
- Simulation of up to 16 simultaneous presses
- Support all type of movements (Scroll, zoom, touch, release..)
- Movements can be scheduled in milliseconds resolution
- Small footprints
- Easy to use test framework with intuitive TouchPro control interface
- Touch press emulation (tap, doubletap, scroll, spread, swipe, drag, ...)
- Fast Video grabbing.
- Touch panel device output recording and analysis (OCR- Optical Character Recognition, frame base analysis, video analysis, ...)
- Graphical user interface for test creation with live preview
- Test monitoring (Digital Video Recording) tool
- Available SDK for system extension and integration with customer devices/SW modules
- Powerful report generation tools

Use cases

- Automated touch panel device functional testing (device behaviour testing, application testing)
- Device stress and long run testing (stability and reliability)
- User interface testing
- Performance/Quality measurement of video playback
- Customer specific tests

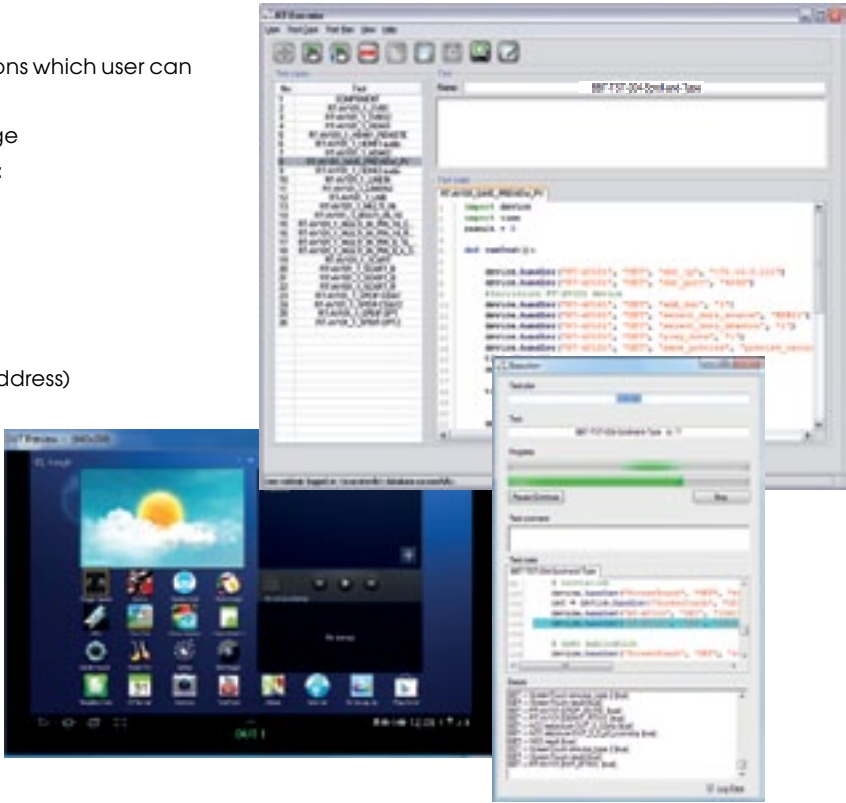


Supported movements



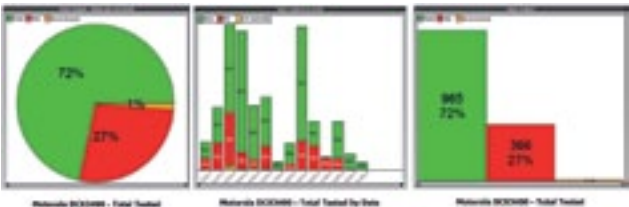
SW Module

- Provides interface for automatic test creation
 - Drawing with mouse
 - Using touch screen digitizer
 - Test editor with predefined actions which user can place and configure
- Test scripts in PYTHON script language
- Various test cases can be executed:
 - Scroll (Left, Right, Up, Down)
 - Hold, drag
 - Multi press, Zoom
 - Run applications
 - Navigate through menu
 - Typing (letters, numbers, Web address)
 - Audio / Video Playback
 - Drawing
 - ...



Reporting

- HTML results available over network.
- Excel based history report.
- Report template generator
- Summary report available for the overall testing



Benefits

- Fully automatic test procedure, no operator is needed during test execution
- System is suitable for Android, iOS and Windows touch panel devices
- Independent of different manufacturers and types of touch panel/display devices
- Test procedure and result logging (database, file system) for off line result analysis
- Various test report presentation (txt, html, excel, ...)

What am I buying?



- TouchPro test system
- RT-Executor application for automatic test execution
- RT-AV100 grabber device
- Test suite*

* Includes adjustments of the tests to client's touch screen device

ACCESSORIES

How to test multiple devices without affecting the efficiency of testing procedure?

RT-RK engineering team prepared a whole set of additional hardware equipment for managing outputs inside automated testing environment and remote control of devices under test.



RT-IR001: Infrared receiver/transmitter and repeater device

i RT-IR001 is a control device for reception and transmission of infrared remote commands. Developed for usage in automated test systems. RT-IR001 finds its application in R&D and QA departments, service centers and on production lines.

Features

- Dimensions: 58mm length, 35mm width
- USB powered device providing full power (up to 500mA)
- LEDs: red for status and green for IR activity (also for learning codes)
- Connections: USB (standard A) connector
- Carrier frequency range: 30-60kHz
- RoHS compliant



Common features

Learns IR commands of any remote controller

- Short range detector (1m) used for signal acquisition and learning through RC Capture application
 - Automatic detection of carrier frequency and toggling data
 - Recording of individual signals
 - Recording of sequences of signals
 - Testing of recorded patterns

Supported RC protocols:

- ITT, JVC, NEC, Nokia NRC17, Sharp, Sony SIRC, Philips RC-5 (including full support for toggle bits), Philips RC-6 (including full support for toggle bits), RCA, R-Step, X-Sat, Panasonic, Daewoo, Pioneer, Yamaha, Grundig

RT-IR016U: 16 unit infrared receiver/ transmitter/ repeater device

i RT-IR016U is a device intended for simultaneous control of 16 IR controlled multimedia devices under test, and as such it finds its use in multi-device testing in R&D and QA departments, service centers, an production lines, and in systems for broadcast monitoring. Each port is independently configurable enabling testing of devices of different models at the same time.

Features

- 19U rack mountable case - 42mm depth
- 16 independent IR outputs (2.5mm plug) that can be used concurrently or in any combination
- Advantageous in case of testing of devices of different make and models
- Front panel indicator LEDs
- Contains an IR receiver for learning of IR signals
- Controlled by RC Capture application via USB connection
- USB powered device providing full power (up to 500mA)
- LEDs: red for status and green for learning codes; 16 green LEDs show IR port activity
- Connections: USB (standard B) connector, 16 2.5mm jack IR output ports
- Driver available for both 32-bit and 64-bit Microsoft Windows platforms



Controlled from a PC application

- Connects to a PC via USB
- Driver available for both 32-bit and 64-bit Microsoft Windows platforms

For single and multi-device STB testing

- Simultaneous transmission of IR commands towards many devices under test ensured using USB hubs

LVDS Splitter

LVDS signal multiplier

i Provides LVDS signal for LCD PANEL and RT-AV030 device by multiplying LVDS input signal from TV motherboard on two identical output signals.



Features

- Contains one LVDS input and two LVDS outputs
- LVDS splitter box supports LVDS formats: 6, 8 and 10 bits per color over 1 or 2 channel (VESA, JEIDA, FP data formats) up to full HD (1920x1080) with 60 pictures per second
- Connector type: JAE FI-RE51HL

Connecting scheme



RT-SPDIF16

16 input digital audio switcher

i RT-SPDIF16 is a digital audio switch for testing of multiple digital audio sources.



Features

- Full S/PDIF digital audio support. Support of all current broadcast/ DVD standards
- High-performance digital audio switcher with 16 S/PDIF RCA connectors and 16 TOSLINK® optical connectors
- Multiple sampling rates - 32kHz to 96kHz
- Maintains signal integrity during transmission without any interference and distortion
- Control - USB, front buttons, and remote controller
- Easy to install and simple to operate

Specification

- Input ports: Optical Toslink x 16, RCA x 16
- Output port: Optical Toslink x 1, RCA x 1
- Supported audio formats: PCM 2Ch, AC3/5.1, Dolby Digital, Dolby 5.1 and DTS 5.1 pass through
- Sampling frequency: up to 192kHz @ 24 bit resolution
- Operating temp: 0C ~ 40C / 32F ~ 104F
- Relative humidity: 20 ~ 90% RH (non-condensing)
- Power supply: USB or 5V DC, 1A

Package

- RT-SPDIF16 device
- Power adapter, USB cable
- CD with installation and documentation

8 port RF switch

i RF switch is an 8 input/1 output and 1 input/8 outputs switch for RF signal in 5-3000 MHz bandwidth. RF inputs are typical female F connectors.



Features

- High performance RF switch with 8 inputs/1 output or 1input/8 outputs
- 2 operating modes:
 - Single pole/single throw
 - Single throw 8-way switch
- 19" 1U rack mountable case
- Connection to PC: USB (standard B) connector
- Used for automated test systems for STBs, DVD players, ...
- RoHS compliant

Specification

- RT-IR08i
 - Input ports: F connectors x 8
 - Output port: 1 F connector
- RT-IR08o
 - Input ports: F connectors x 1
 - Output port: 8 F connector
- Frequency bandwidth: 5-3000 MHz
- Low insertion loss:
 - 0.5 dB at 1 GHz
 - 0.65 dB at 2 GHz
- Isolation:
 - 34.5 dB at 1 GHz
 - 25 dB at 2 GHz
- High ESD tolerance of 1.5 kV
- Operating temp: 0C ~ 40C / 32F ~ 104F
- Relative humidity: 20 ~ 90% RH (non-condensing)
- Power supply: USB or 5V DC, 1A

Package

- RT device
- Power adapter, USB cable
- CD with installation and documentation

8 port SCART switch

i SCART switch is an 8 input analog audio/video SCART switch for testing of multiple analog AV sources. SCART inputs are typical 21-pin female connectors..



Features

- High performance analog audio and video switcher with 8 21-pin female SCART connectors
- 19" 1U rack mountable case
- Connection to PC: USB (standard B) connector
- Used for automated test systems for STBs, DVD players, ...
- Supported interfaces: Composite, Component, pin 8, pin 16, Stereo audio
- V-synchronized detection
- RoHS compliant

Specification

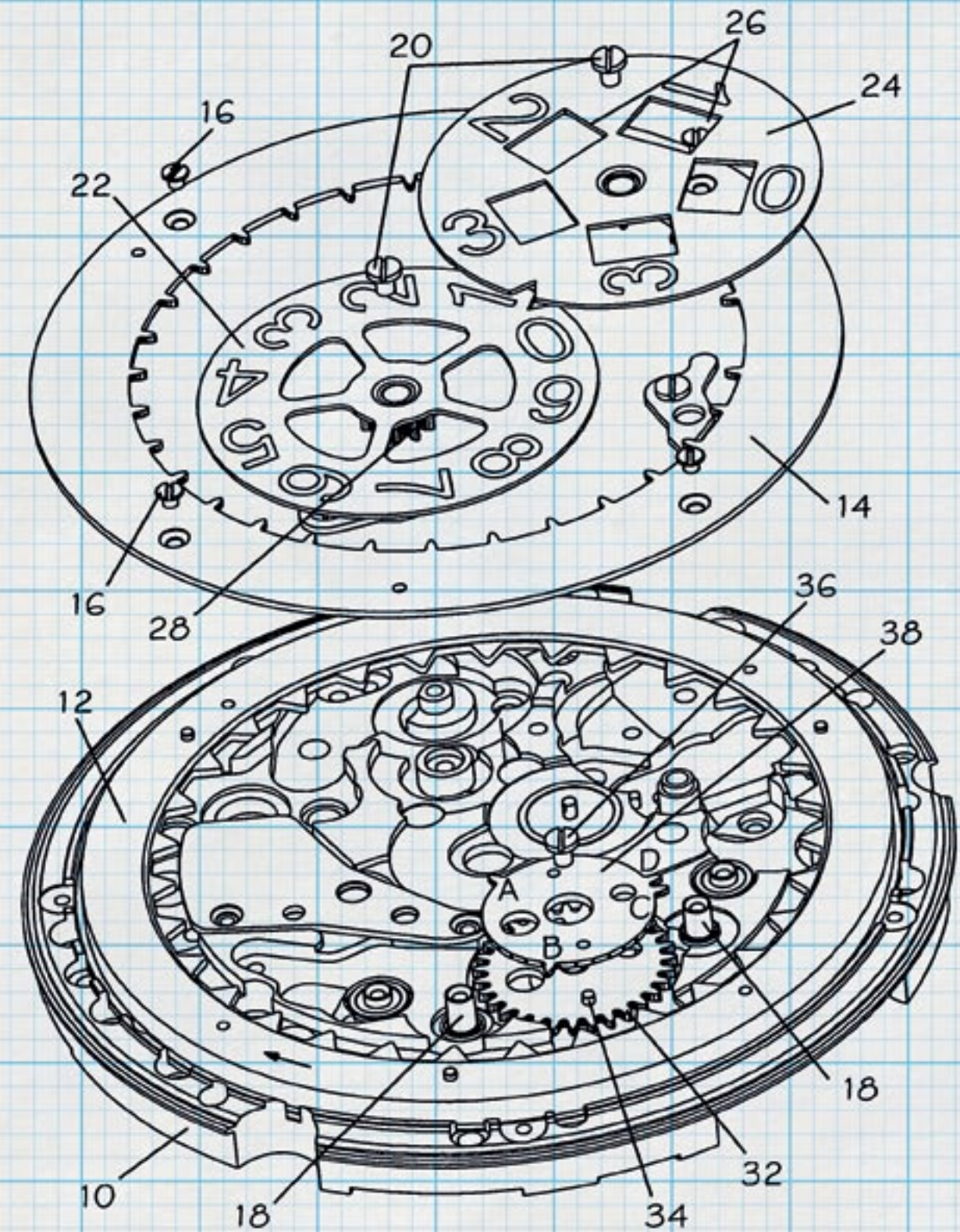
- Input ports: 21-pin female SCART connectors x 8
- Output port: 21-pin female SCART connector x 1
- Supported audio formats: stereo analog
- Operating temp: 0C ~ 40C / 32F ~ 104F
- Relative humidity: 20 ~ 90% RH (non-condensing)
- Power supply: USB or 5V DC, 1A

Package

- RT-SCART8 device
- Power adapter, USB cable
- CD with installation and documentation

SOFTWARE

INTENT+ was developed by 15 engineers engaged on a two-year project. It was first deployed at Vestel, third largest OEM in the world and the largest European TV manufacturer.

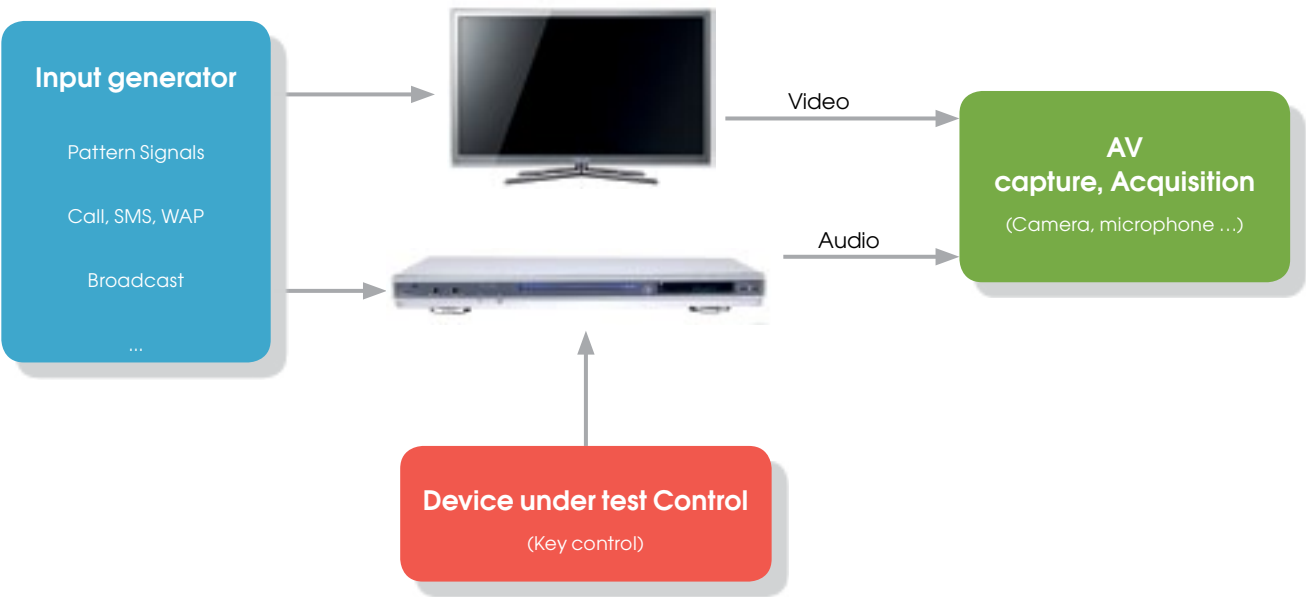
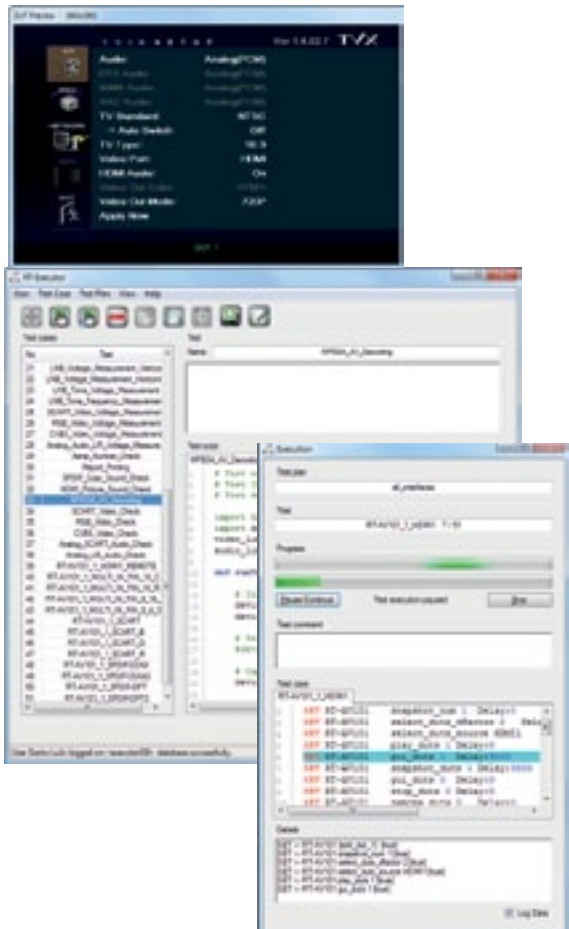


Fully automated test execution system

RT-Executor is a sophisticated tool for control, development and execution of BBT automated test solutions. It enables smooth integration with measurement instrumentation, signal generators and modulation equipment, data acquisition devices, all in plug & play manner. It contains a comprehensive set of libraries for video and audio data analysis, database benefits in reporting and multiple user/rights approach, and support for Python based scripting.

RT-EXECUTOR features

- **Hardware integration:** RT-Executor seamlessly integrates third party and BBT instrumentation via RS232, LAN, GPIB, PCI, TCP/IP and USB interfaces as plug & play devices.
- **Analysis:** Access comprehensive set of built in functions and libraries for video and audio analysis.
- **Double programming technique:** Develop your test cases in BBT or Python like style. Use Python scripting quality, portability, support and integration mechanisms for a quick and facile start with RT-Executor.
- **Multi-platform approach:** Take advantage of Black Box Testing (BBT) concept of generalized device and use RT-Executor to test SOC and encased products.
- **Data storage and reporting:** Store your test results in a local database. Share them in HTML and Microsoft Excel format.



Supported devices

 <p>Fluke 54200 Multi standard video and TV signal generator</p>	 <p>Rohde & Schwarz SFQ Digital signals generator for antenna, satellite and cable</p>	 <p>QuantumData 882 Multi standard programmable video signal generator</p>	 <p>Rohde & Schwarz SFU Broadcast test system</p>
 <p>Astro VG-84 Multi standard programmable video signal generator</p>	 <p>Audio Precision 2722 Audio analyzer</p>	 <p>Master MSPG1025 Multi-standard programmable video signal generator</p>	 <p>DekTec DTA-115 Multi-standard VHF/UHF modulator for PCI bus</p>

How does RT-Executor works?

Test execution steps

- Load test system configuration
- Initialization and control of input devices (generators)
- Initialization and control of output devices (grabbers)
- Configuration and control of device under test (DUT)
- Test scenario execution – semiautomatic or automatic
- DUT A/V output collection and processing

3 day test project training course

- **Day 1:** System introduction: HW + SW setup
- **Day 2:** Tests creation and run: practical demonstration of test creation, test project preparation and test execution
- **Day 3:** Device driver creation: exercise how to write proprietary device driver

Package content

- CD with SW installation and documentation
- USB node lock

Software

- GUI application
- Device manager
- Device drivers (more than 50 drivers)

Documentation

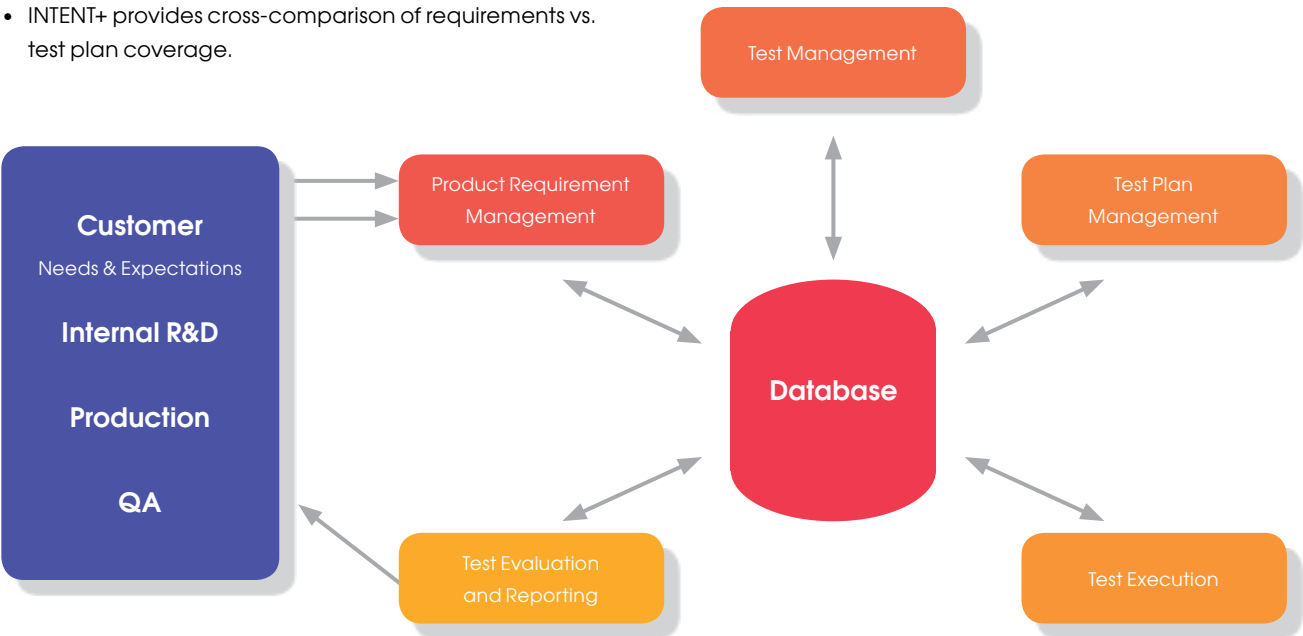
- User manual
- Test creation manual
- Tests samples

SYSTEM REQUIREMENTS

- Microsoft™ Windows® XP
- Microsoft™ Windows7 32 bits
- 2GHz Intel™ or AMD™ DualCore CPU
- 2GB RAM
- 100MB free disk space

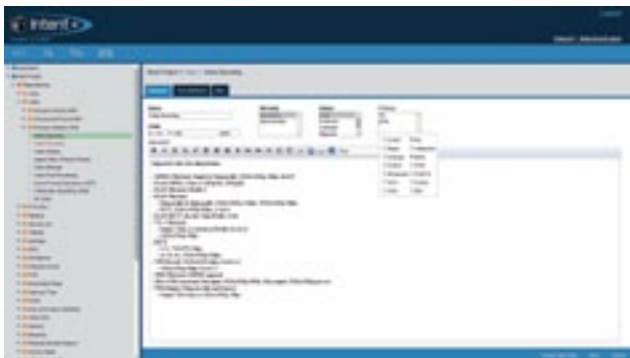
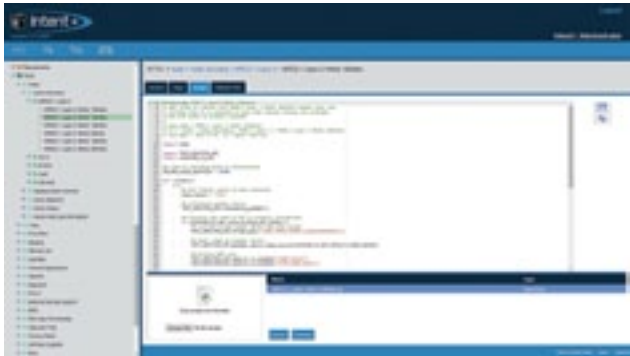
Integrated test environment

- INTENT+ is a test management and test execution software intended to assist Quality Assurance through the project lifetime.
 - INTENT+ provides web access to Test Management modules (INTENT-RM, INTENT-TM, INTENT-TPM and INTENT-TR).
 - INTENT+ provides cross-comparison of requirements vs. test plan coverage.
- INTENT+ is scalable from single site, single project to multiple sites-projects, increasing testing efficiency through test-plan and test-cases reusability.
 - INTENT+ has powerful reporting tool with predefined set of KPI for the project.



INTENT+ features

- Four out of six management modules are web-based applications which can be used without additional installation
- Modules can be included inside single framework
- Modular solution - clearly separation of presentation (GUI) and core layer.
- Core layer is divided into Business Logic and Data Access layer
- Supports different types of interpreter: Test cases can be written in Python or solution proprietary language
- Manual, semi-automatic and automatic test execution
- Connection with bug tracking system
- Support of user management, user responsibility and workflow tracking mechanism
- Mail notification mechanism
- Excel export mechanism
- Integrated document/report generator with lot of predefined documents/reports
- Support for Jasper/MS Word based document/report templates



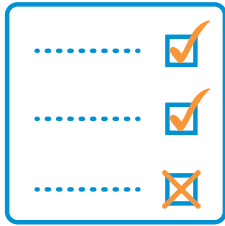
INTENT+ modules



INTENT-RM*

Product requirements creation, modification and maintenance

- Project requirements are maintained through this module, which also supports requirement customization through template mechanism as well as rapid reuse using embedded synchronization module.
- Requirements describe in detail what needs to be tested and provide the test team a corner stone for entire testing process.



INTENT-TM*

Test case Management

- INTENT-TM provides ways to create and manipulate test cases, as well as to reuse existing test cases in various projects.
- Module includes script editing feature for automatic tests, as well as functionalities and interface suitable for rapid entry of manual test cases.



INTENT-TPM*

Test system configuration and Test Plan Management

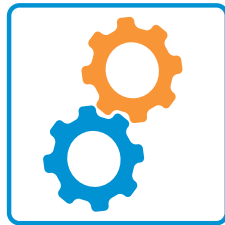
- Test system configuration module provides environment for defining devices and modules which will be included in the test system (device under test, generators, grabbers, control devices, algorithms, etc).
- In this module user prepares test bed and defines devices included in test process and interfaces for communication between executor and selected devices.
- Presented system will also handle creation and modification of master and execution test plans.



INTENT-TE*

Reporting/Evaluator module

- Evaluator module is responsible for test cases' execution, process results' evaluation, defects' and errors' handling and back connection to requirement.
- Various types of already available reports/KPIs.
- Possibilities to generate custom reports/KPI.



RT-EXECUTOR

Test Executor

- It provides possibilities of manual and automatic test cases or test execution.
- RT-Executor controls equipment necessary for test execution process, controls test execution scheduling and handles test results.



RT-API

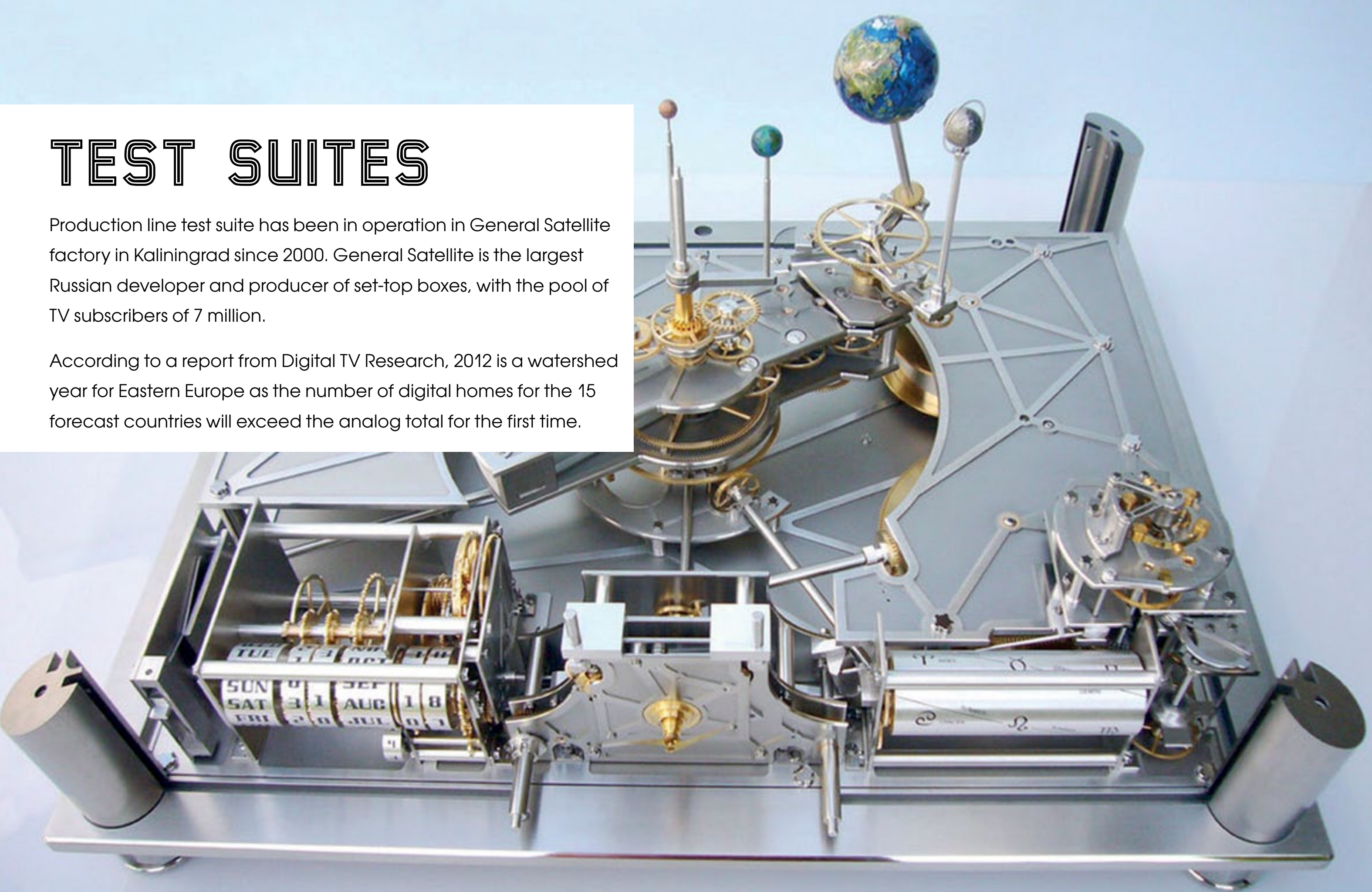
API module

- Provides SOAP web service for 3rd party test automation system integration
- Provides REST interface for automated requirement/test management

TEST SUITES

Production line test suite has been in operation in General Satellite factory in Kaliningrad since 2000. General Satellite is the largest Russian developer and producer of set-top boxes, with the pool of TV subscribers of 7 million.

According to a report from Digital TV Research, 2012 is a watershed year for Eastern Europe as the number of digital homes for the 15 forecast countries will exceed the analog total for the first time.



Test environment that allows reliable testing of functionality of digital receivers (STB). It represents a complete solution for reliable automatic verification of STB combining both hardware and software, with test scenarios which are easily adaptable to different types of STB.



To whom is it intended?

Due to its physical features, primarily size of the deployed device (RT-AV100), user friendly application (RT-Executor), and easily extensible set of tests, the system finds its application in different phases of STB life cycle. These make the system a perfect choice for **software vendors**, **original equipment manufacturers (OEM)** and **digital TV operators**.

They all have a need for **frequent testing** of their devices, depending on frequency of new versions of software production. Such situations require investigation of a device's reaction to the changed software (updates, adding new features), but also must establish that there is no negative impact on accuracy of the features implemented in previous versions of the software (**regression testing**).



OEM

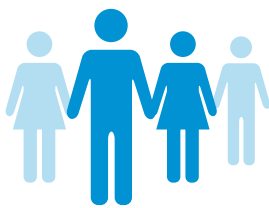


Software vendor

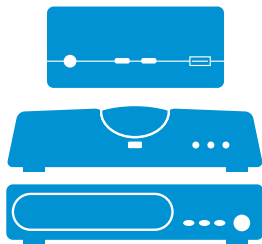


TV Operator

How it improves your productivity?



Reduces human interference



Independent of different manufacturers and types of STB



Accelerates time to market



Easily integrates 3rd party testing equipment

How does it work?

Functional testing of STB assumes that audio and video interfaces of the tested device are electrically correct. System is also **independent of STB signal feed** (different types of tuners and modulations - DVB-T, DVB-T2, DVB-S, DVB-S2, DVB-C, IP).

The system records output audio and video content, and based on their comparison with referent content, by using various algorithms, decides whether the tested condition is correct or not.

Functional testing of STB recognizes two categories: testing against a golden reference (**golden reference**) and testing against a reference unit (**golden device**).

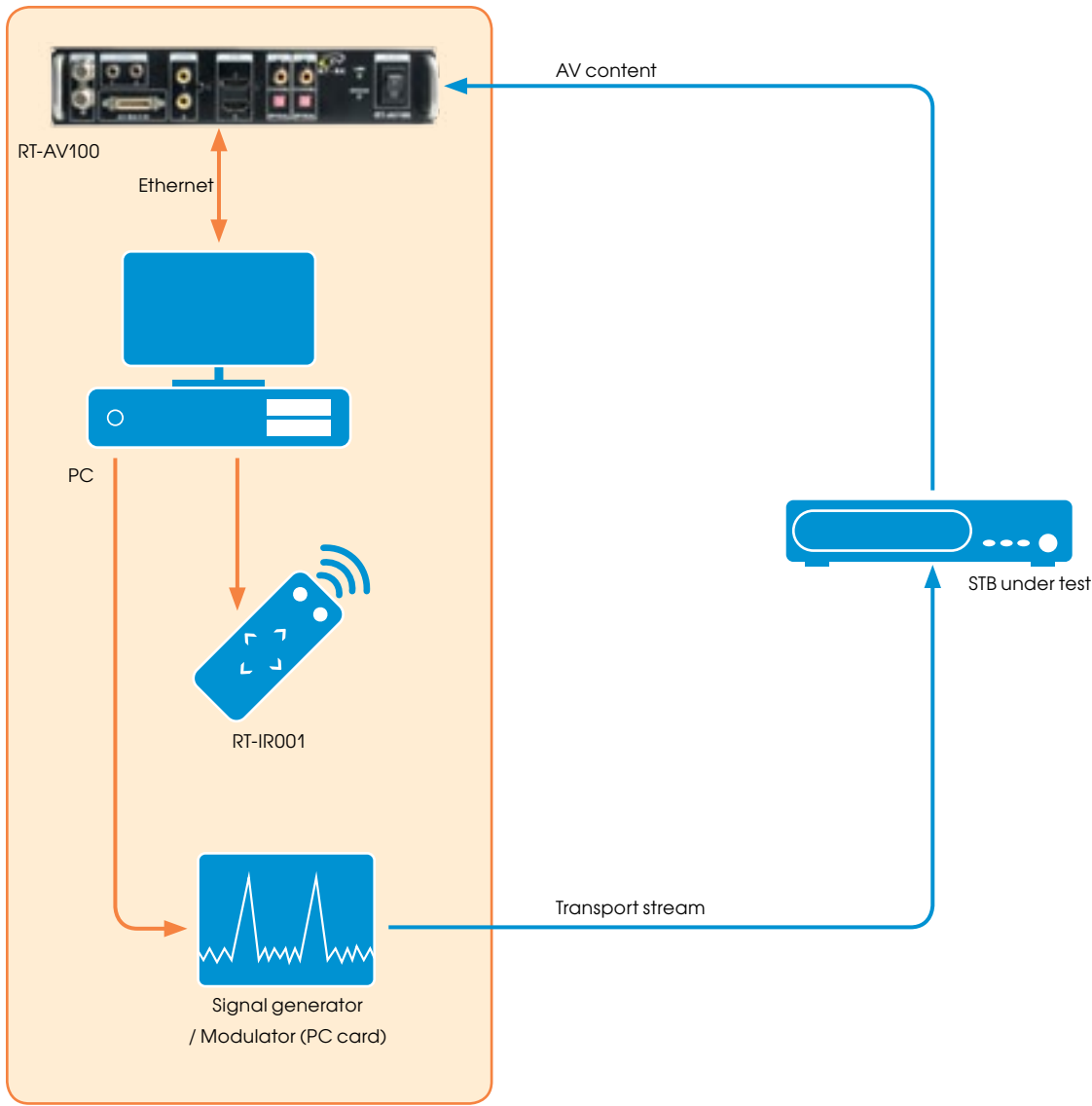


What is tested?

Errors that can be detected by this system are diverse, as the set of tests executed covers all the functionality of an STB:

- GUI, RC
- Interfaces
- Video decoding
- Audio decoding
- Tuning/scanning
- TXT, subtitle
- Performance
- ...

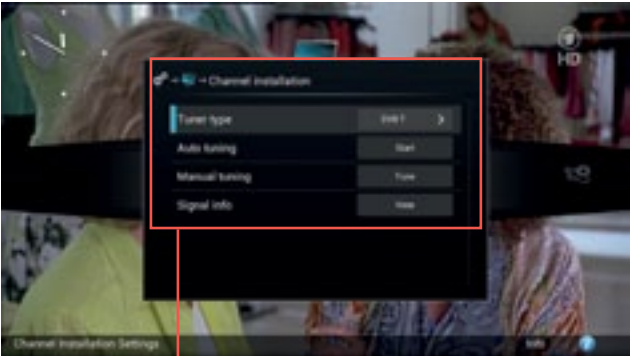
How to build the environment?



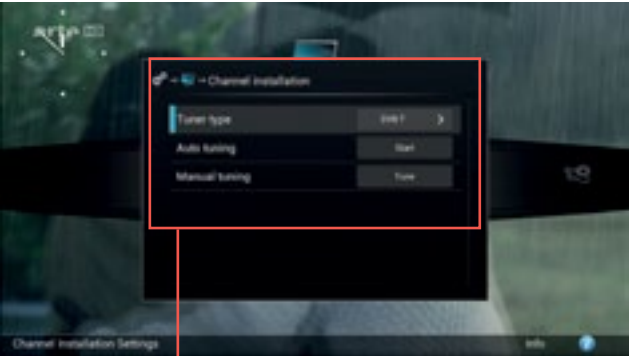
Most commonly detected errors

Irregularities within user interface

Example 1: Menu



Channel installation
Tuner type DVB-T
Auto tuning Start
Manual tuning Tune
Signal info View



Channel installation
Tuner type DVB-T
Auto tuning Start
Manual tuning Tune

Example 2: EPG

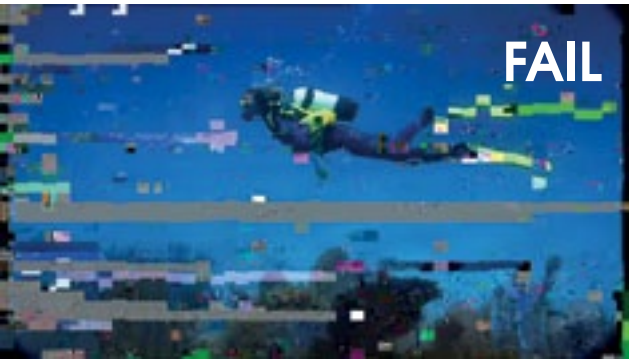


206 NVT Extreme Sport 1424_4_NL_72min_0+ ...



206 NVT Extreme Sport 1424_4_NL_72min_0+

Bad decoding of audio and video signals



Color / Brightness / Sharpness / Contrast failures

Color change



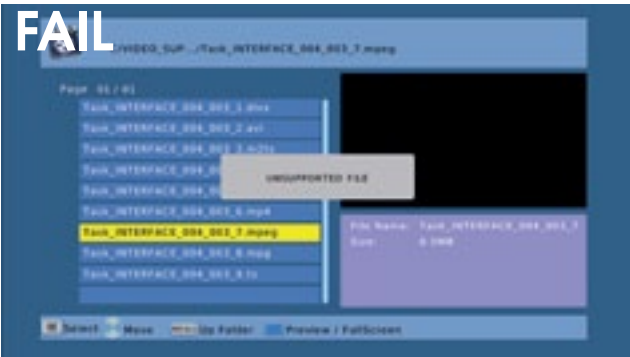
Brightness change



Sharpness / Contrast change



External media storage / shared content playback error (USB, DLNA, etc.)



What am I buying?

The System for functional testing of STB consists of:

- HW - RT-AV100 device for recording of audio and video content
- SW - RT-Executor application for system and test management
- Test Suite - a set of 305 tests which cover all the functionalities of a standard STB.



* Includes adjustments of the tests to client's STB.

FUNCTIONAL TEST SUITE			
Test Group/Case Description	TESTS	Test Group/Case Description	TESTS
GUI, RC	56	TUNING/SCANNING	48
Test Set <001>: Menus	8	Test Set <001>: Frequencies	12
Test Set <002>: OSD Messages	17	Test Set <002>: Transmitting Parameters	20
Test Set <003>: Language Translations	3	Test Set <003>: Changes In Modulation Parameters	4
Test Set <004>: EPG	4	Test Set <004>: Tuning/Scanning Procedures	12
Test Set <005>: Indicators	6	TXT, Subtitle	13
Test Set <006>: RC Keys	18	Test Set <001>: TXT	8
INTERFACES	62	Test Set <002>: Subtitle	5
Test Set <001>: HDMI	11	PERFORMANCE	41
Test Set <002>: SCART	9	Test Set <001>: Program Management	18
Test Set <003>: S/PDIF	5	Test Set <002>: Aspect ratio	5
Test Set <004>: USB	37	Test Set <003>: Program navigation	18
VIDEO	25	MISC	10
Test Set <001>: MPEG2 SD Resolutions	4	Test Set <001>: Miscellaneous	10
Test Set <002>: MPEG4 SD Resolutions	4	LAN	12
Test Set <003>: MPEG4 HD Resolutions	2	Test Set <001>: LAN Status	9
Test Set <004>: Supported Video	12	Test Set <002>: Media server	3
Test Set <005>: Supported Pictures	3	Total	305
AUDIO	38		
Test Set <001>: MPEG Layer 2	6		
Test Set <002>: E-AC3	6		
Test Set <003>: AC3	6		
Test Set <004>: HE AAC	3		
Test Set <005>: AAC	3		
Test Set <006>: Supported Audio	7		
Test Set <007>: Volume Level Adjustment	5		
Test Set <008>: Audio Selection	2		

RT-TS-STB-S

A complete test environment for the most reliable simultaneous testing of multiple digital receivers (STB) which puts greater emphasis on robustness, availability and error handling under a heavy load.



To whom is it intended?

During its life cycle a STB will be turned on and off many times, thousands of times will perform channel scan and TV signal decoding. Despite all this, the functionalities such as EPG and DVR will have to keep the required level of reliability. This system has been developed to meet the overwhelming challenges as for STB reliability during its long term operation and life cycle. It provides **software vendor**, **OEM**, and **TV operator** with a system for simultaneous verification of multiple STB units, with the main emphasis on greater statistical reliability of their devices. This is achieved by a large number of repetitions of tests (so-called **stress test**) and detection of possible malfunctioning in long-term exploitation (so-called **soak test**).



OEM

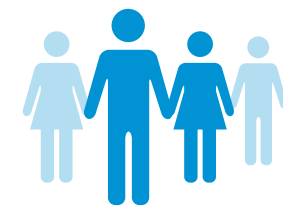


Software vendors

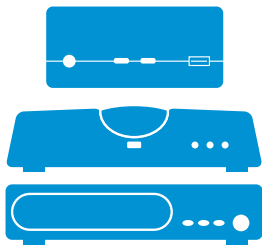


TV Operators

How it improves your productivity?



Reduces human interference



Independent of different manufacturers and types of STB



Increases throughput of tested devices



Increases reliability of tested devices

How does it work?

The system consists of tested devices (up to 16) each of them being connected to one of the grabber devices (RT-AV100) and managed by a dedicated RC emulator. After all the tested devices have been brought to a desired state, a simultaneous recording of output video and audio content is performed for all the units. The application performs processing and analysis of the recorded files using pre-defined algorithms. The analysis is based on a comparison with referent content, followed by designating a device by "correct" or "malfunctioning".

The system can be used in:

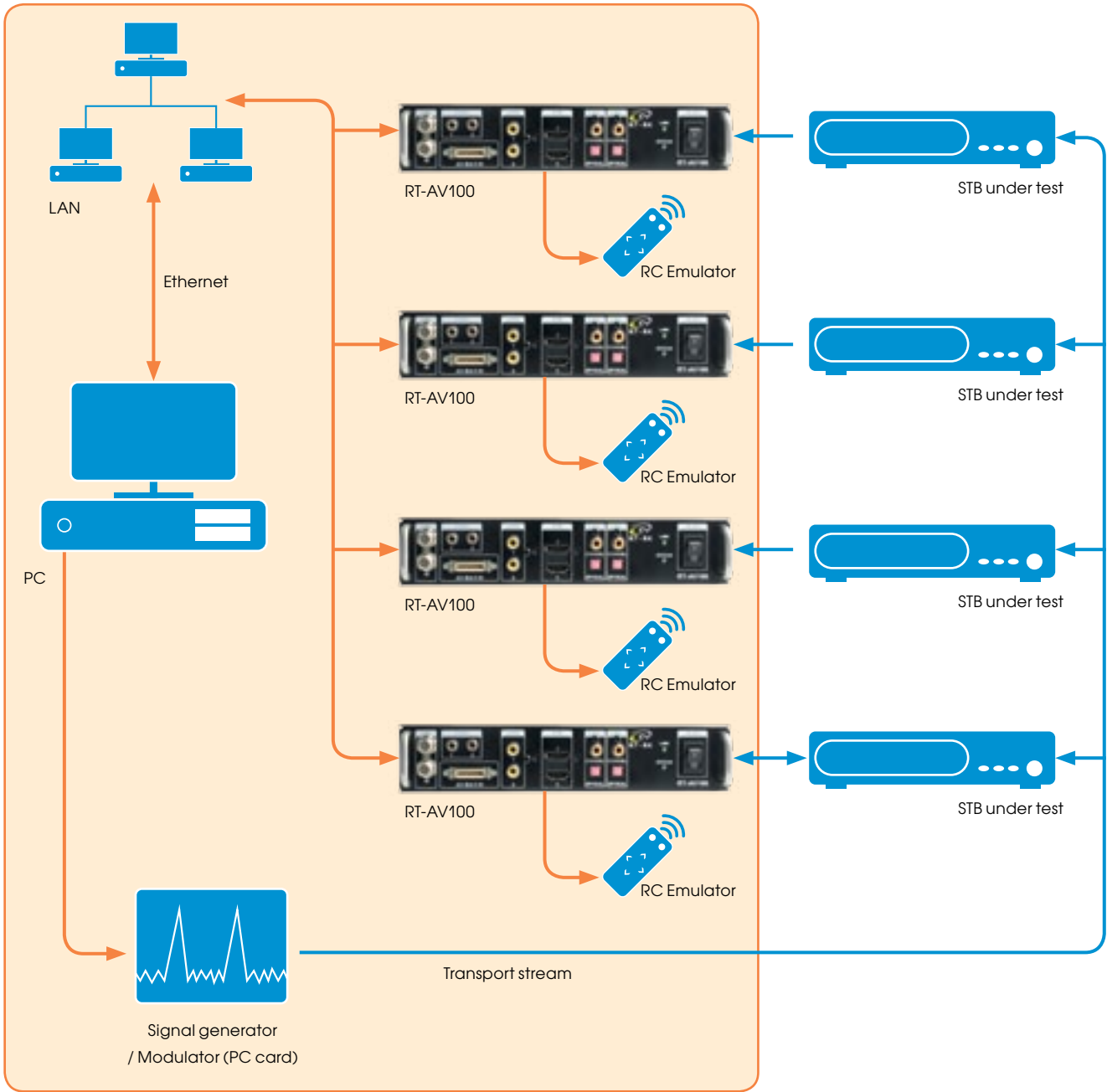
- "Golden reference" and
- "Golden device" set-up



What is tested?

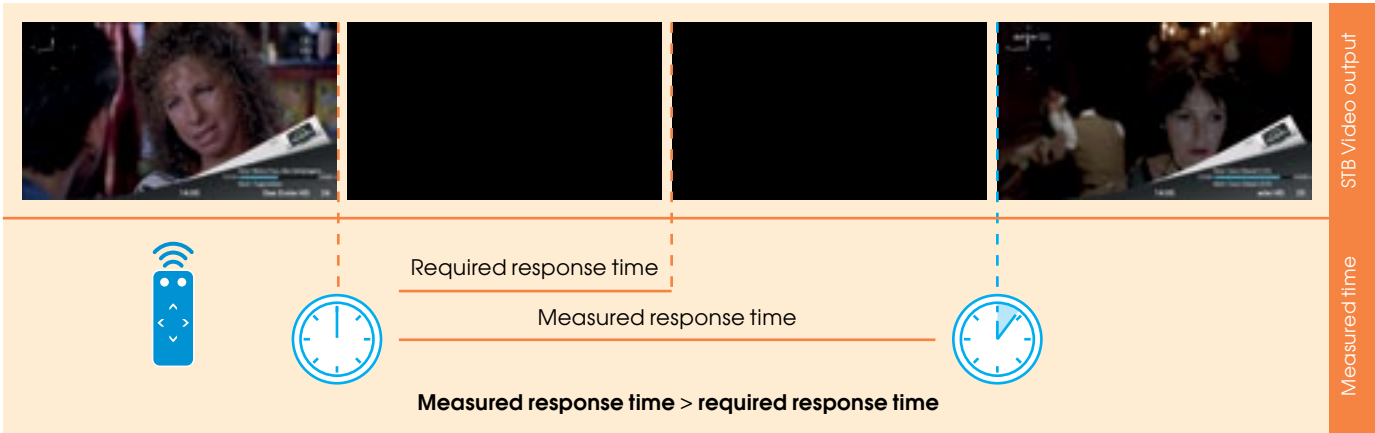
It is intended to be used for testing of STB complex features, and puts greater emphasis on robustness, availability and error handling under a heavy load, rather than normal circumstances. In such conditions stability of work in all operational modes and preserving system's performance after a long-term exploitation is of immense importance, and that is exactly the intention of Stress Test Suite.

How to build the environment?

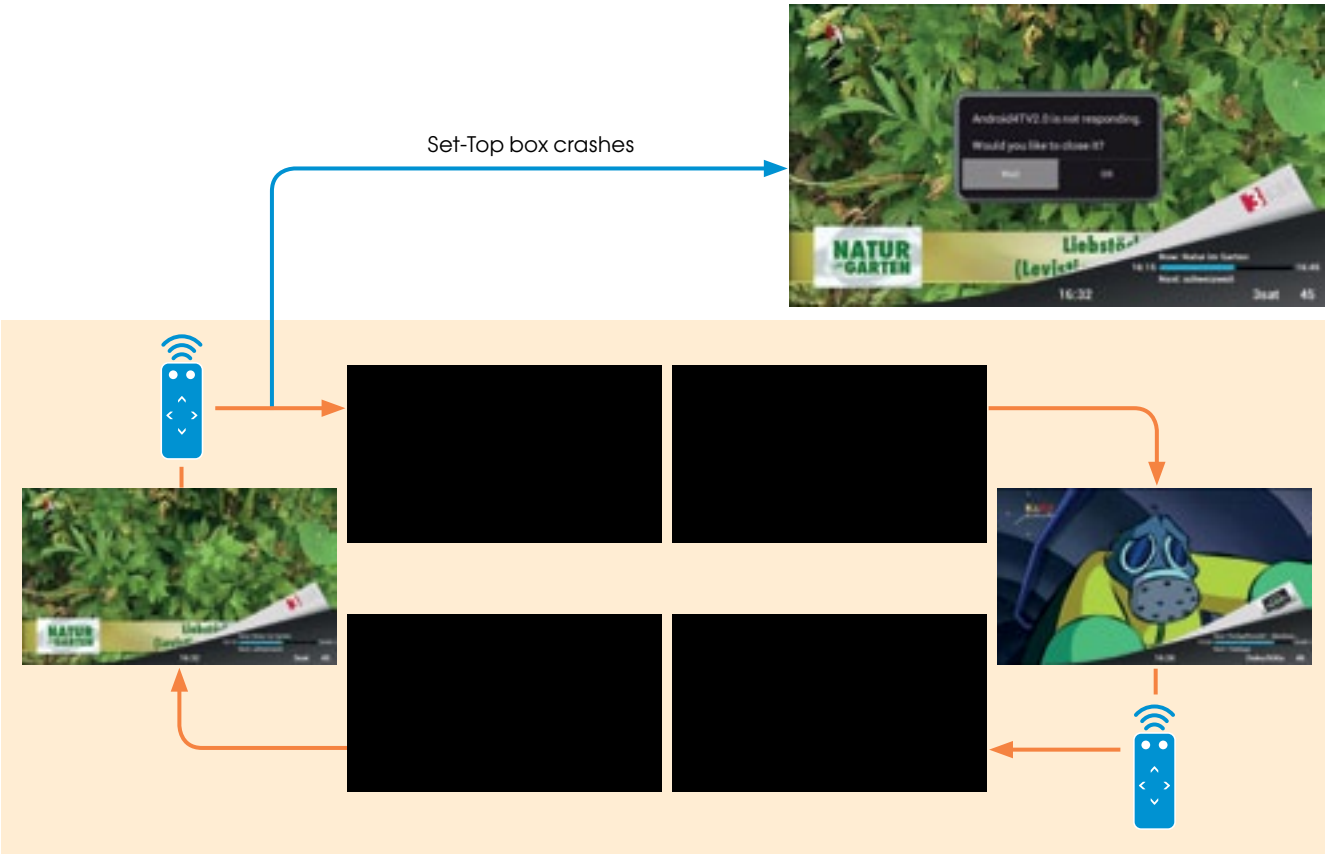


Most commonly detected errors

STB's unsatisfactory response time to commands addressed by RC emulator

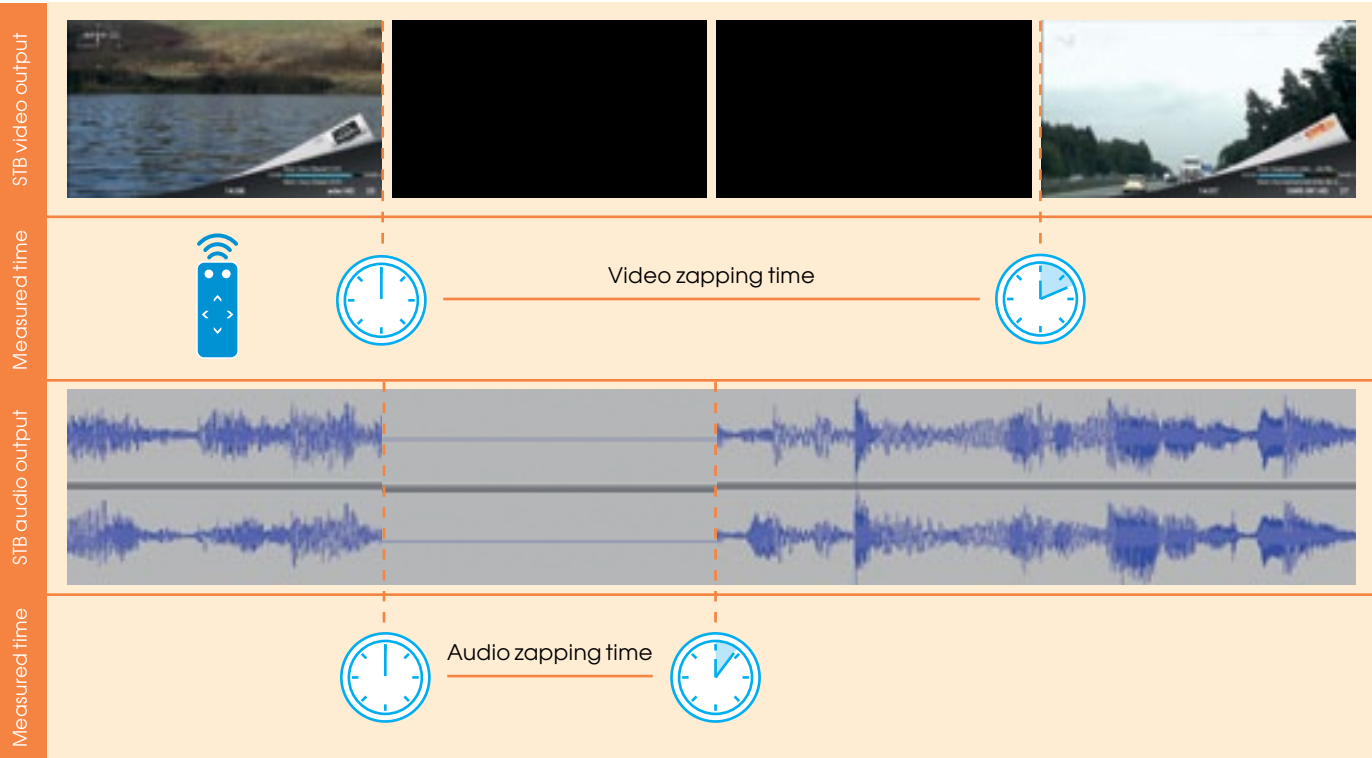


Instability of the device in frequent and long-term channel change (zapping)



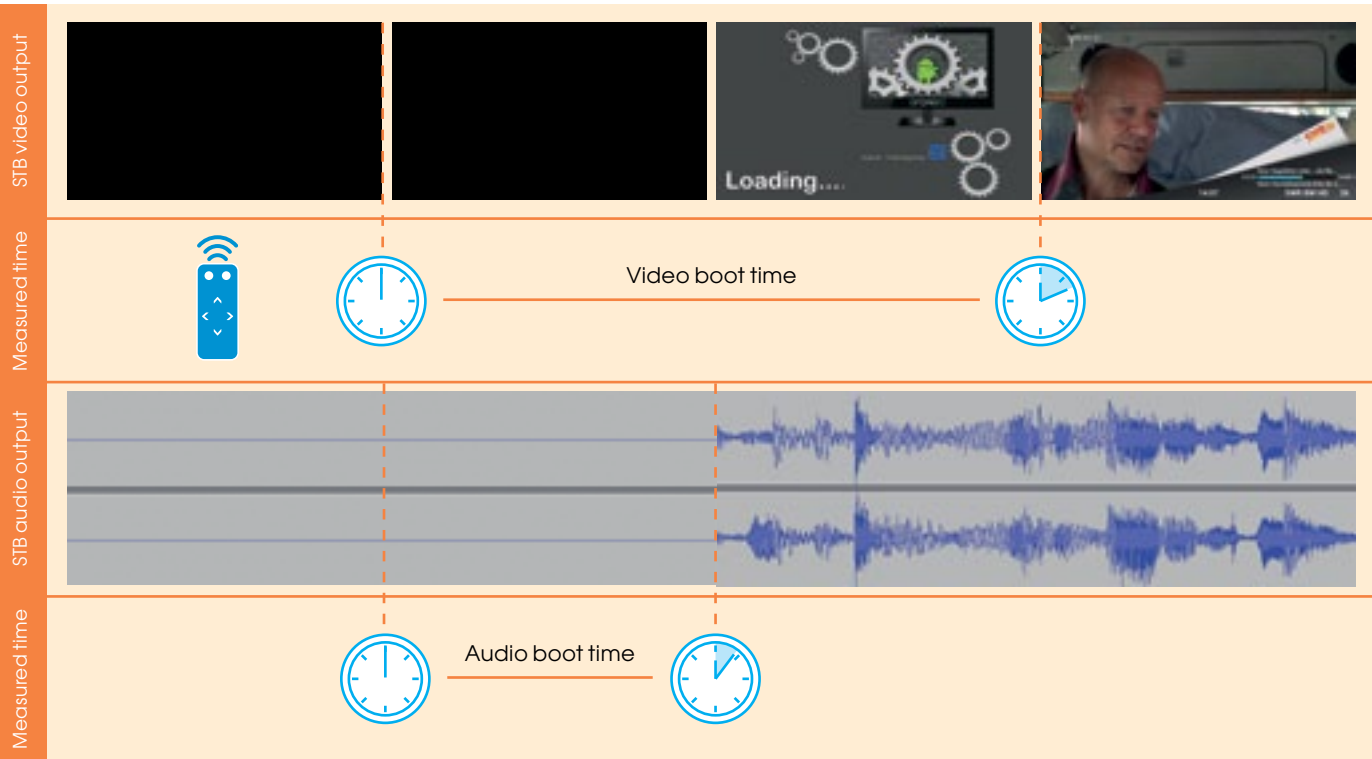
Measuring zapping time

Measuring of channel change/zapping time (especially from an SD to an HD channel, or when changing a transponder at a device that supports DVB-S/S2)

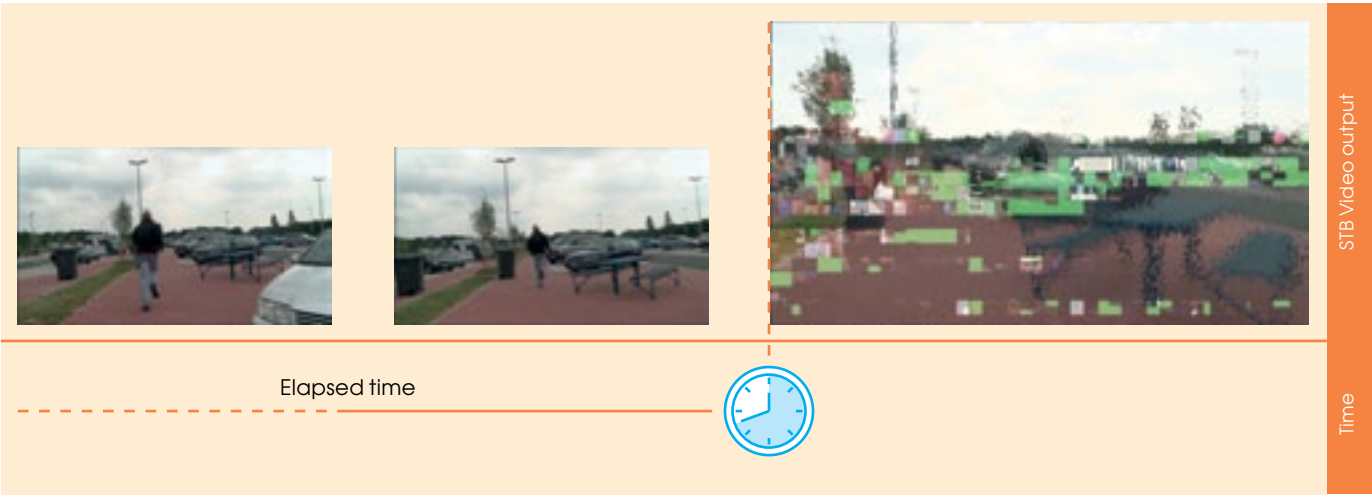


Measuring boot time

- Measuring of the time needed to turn on the unit from stand-by mode
- Measuring of the time needed to turn on the device from power off mode



Errors in TV signal decoding in long-term operation



What am I buying?

A delivered system consists of two 19 " racks with:

- Workstation (PC) + monitor, keyboard, mouse
- RT-Executor application
- 16 RT-AV100 devices for audio and video recording
- 16 RC emulators
- LAN switch
- Test suite

* The described system accommodates 16 STB units. System size is scalable, and fully configurable to meet customer's needs

** The system comes fully assembled (completed cabling).



STRESS TEST SUITE

Test Group/Case Description	
Interfaces	5
Test Set <1>: HDMI	2
Test Set <2>: SCART	2
Test Set <3>: S/PDIF	1
RC keys	27
Test Set <1>: Program Selection	5
Test Set <2>: EPG	1
Test Set <3>: Favorite	2
Test Set <4>: Info Bar	2
Test Set <5>: Menu	2
Test Set <6>: Volume change	2
Test Set <7>: TXT	1
Test Set <8>: Mute	3
Test Set <9>: Color, Shortcut keys	4
Test Set <10> Zoom	1
Test Set <11> PIP/PAP	4
Tuner Tests	3
Test Set <1>: Program Search, Installation	3
Power Management	1
Test Set <1>: Stand by	1
Total	36

A complete test environment for the most efficient and economical way of reliable functional testing of digital receivers (STB). Controllable switchers allow for the application to simulate test scenarios on each STB within the test environment.

To whom is it intended?

Having been developed to respond to the challenge of testing of numerous units at the same time, "round robin" is an ideal solution for operators of **digital TV signals** and **STB service centres**.

Introduction of new services, new head-end equipment, changes in broadcast signal, and new software updates by software producers, force operators to periodically test their devices in order to determine whether they respond to changes in configuration. A large number of STB, of different models and/or different manufacturers, arrive daily at service stations due to malfunctioning.



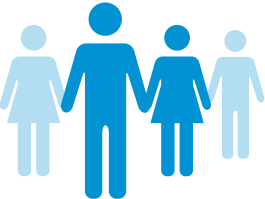
TV Operators



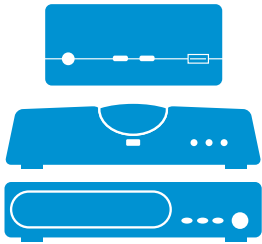
STB service centers




How it improves your productivity?




Reduces human interference




Independent of different manufacturers and types of STB



Increases throughput of tested devices



Cost effective solution



Easily integrates 3rd party testing equipment

How does it work?

In overall, the testing scenario is as follows: IR commands are sent to each of the 24 devices using the STB emulator RC RT-IR016U. After all the tested devices have been brought at the desired state, the application performs "roll-call" of each successive unit. These include changes of input on switchers and, depending on the requirements of the test, recording of output video and audio content. The scenario follows with the application performing processing and analysis of the recorded files using predefined algorithms. The analysis is a comparison of the recorded content with the reference content, and its results decide on the correctness of the unit's behavior.

The system has two options:

- Testing against a golden reference
- Testing against a referent unit ("golden device")



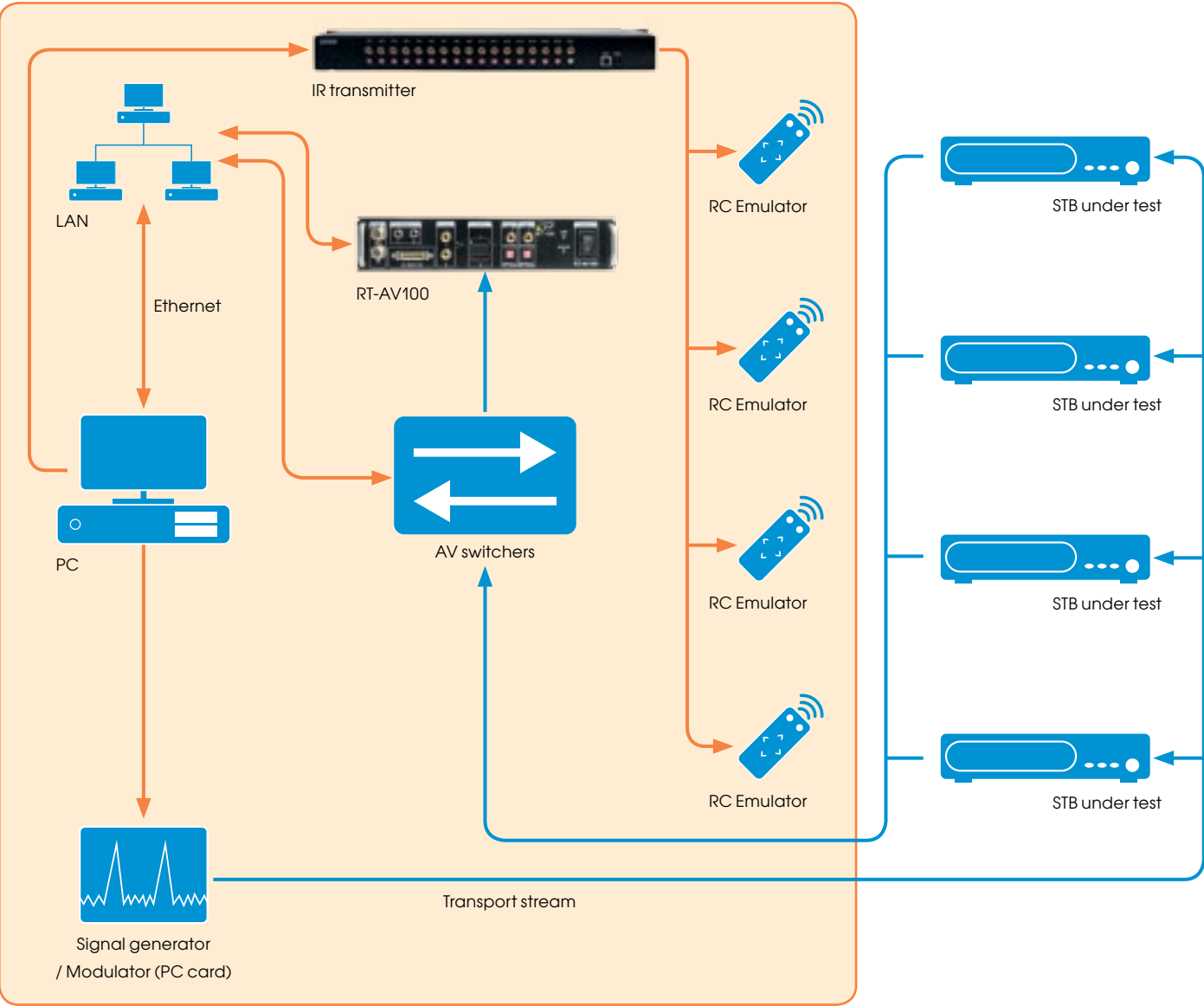
What is tested?

Since it was developed to respond to the challenge of testing of larger number of STB units, this system finds its main purpose in:

- Acceptance testing – testing of new STB units for the customer base
- Functional testing – testing/diagnostic of returned used units, for repair, or from users who terminated their subscriber contracts.

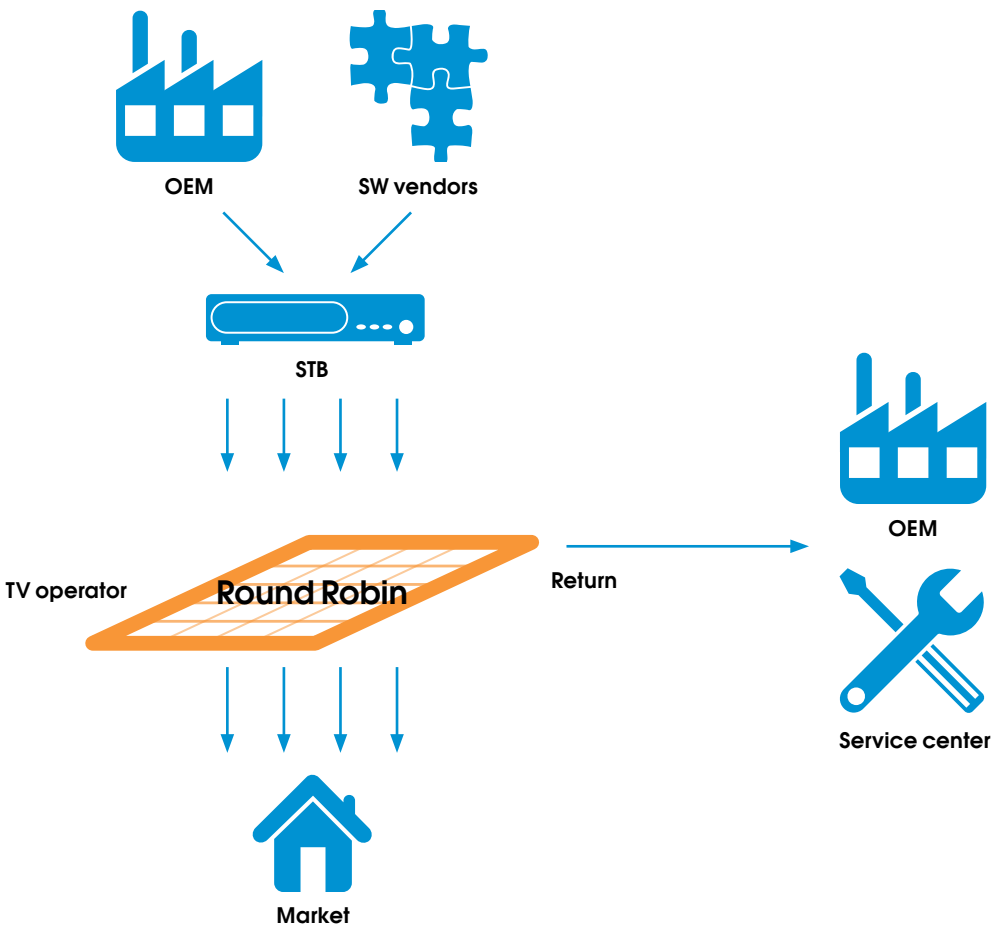
Basically, this means that it can test all functionalities of a STB (GUI, RC, video and audio decoding...), as well as perform measurements of some characteristic values (such as **zapping time** and **boot time**).

How to build the environment?



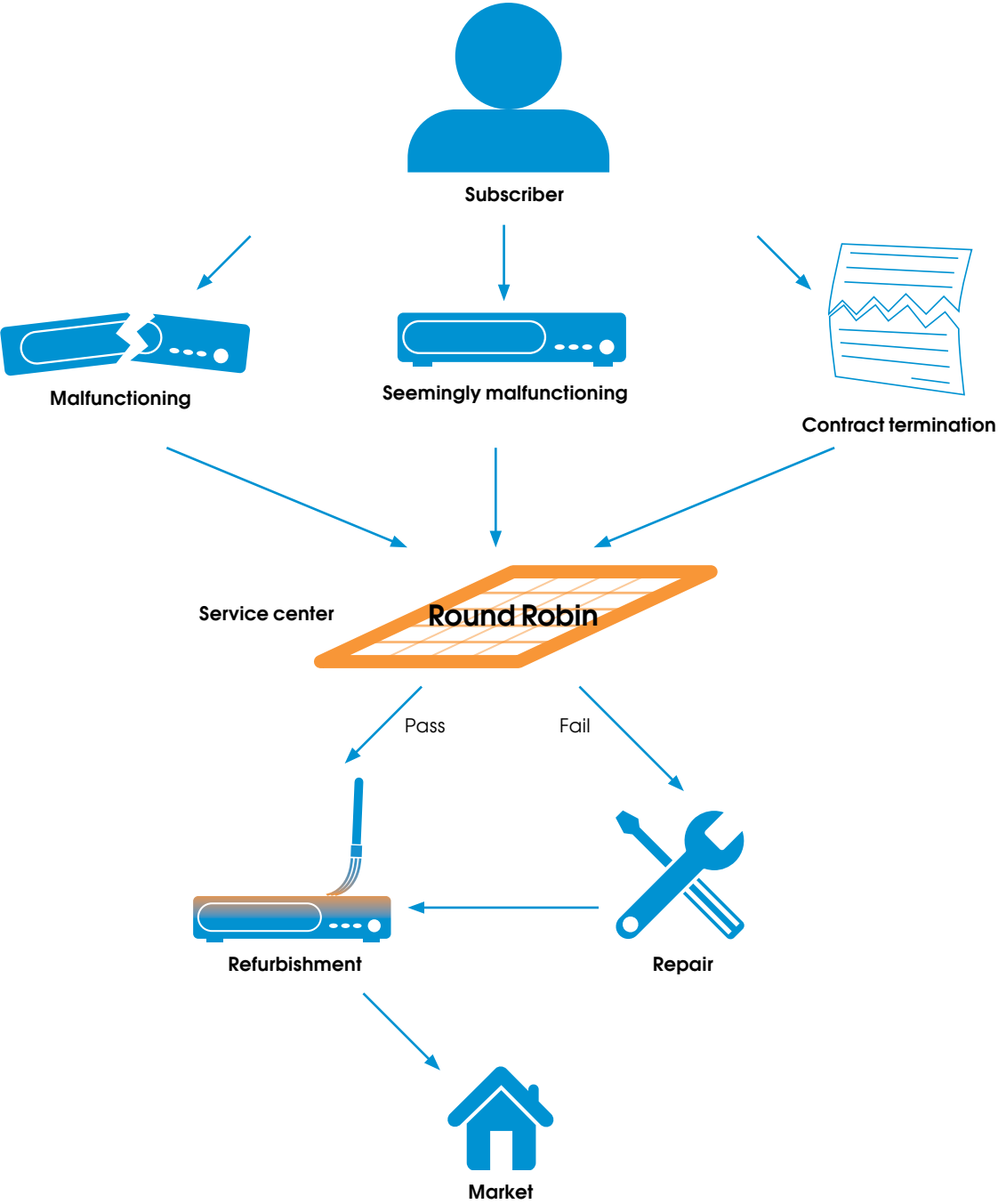
Use cases

Acceptance testing



In the acceptance testing use case RT-TS-STB-RR is used to determine if the requirements of a specification or contract are met. Being a very economical solution that conducts tests on a larger number of STB units in about 30 seconds, it is very practical before market placement for final tests against required standards, or after a software upgrade.

Units returned by users to TV operator



In the use case where STB units are returned to an operator whether due to contract termination or malfunctioning unit, RT-TS-STB-RR is an excellent solution for a quick classification of STB units from where they are sent either to reparation or refurbishment.

What am I buying?

Delivered system consists of two 19 "racks with:

- Workstation (PC) + monitor, keyboard, mouse
- RT-Executor application
- 2 RT-AV100 devices for audio and video content recording
- 2 RT-IR016U + 26 RC emulator
- 2 HDMI switcher - 16 ports each
- 2 CVBS I analog audio switchers - 12 ports each
- 2 S/PDIF switchers (optical and coaxial) - 16 ports each
- LAN switch
- Test suite

* The described system tests 24 STB units. System size can vary, and is scalable to meet needs of client

** The system comes fully assembled (completed cabling)



Failures due to increasing complexity and improper use of STBs are expected, resulting in returning of the device for repair, regardless if physical damage or software type error. STB Diagnostic Station is a perfect automated solution for fast diagnostic of the returned units.



To whom is it intended?

Manufacturers and **distributors** of Set-Top Boxes (STB) face with the issue of returned devices due to numerous problems occurring during exploitation. These malfunctions can be caused by various reasons, either in software (bugs in device's functionality) or hardware (damages caused by improper use or malfunction of the hardware).

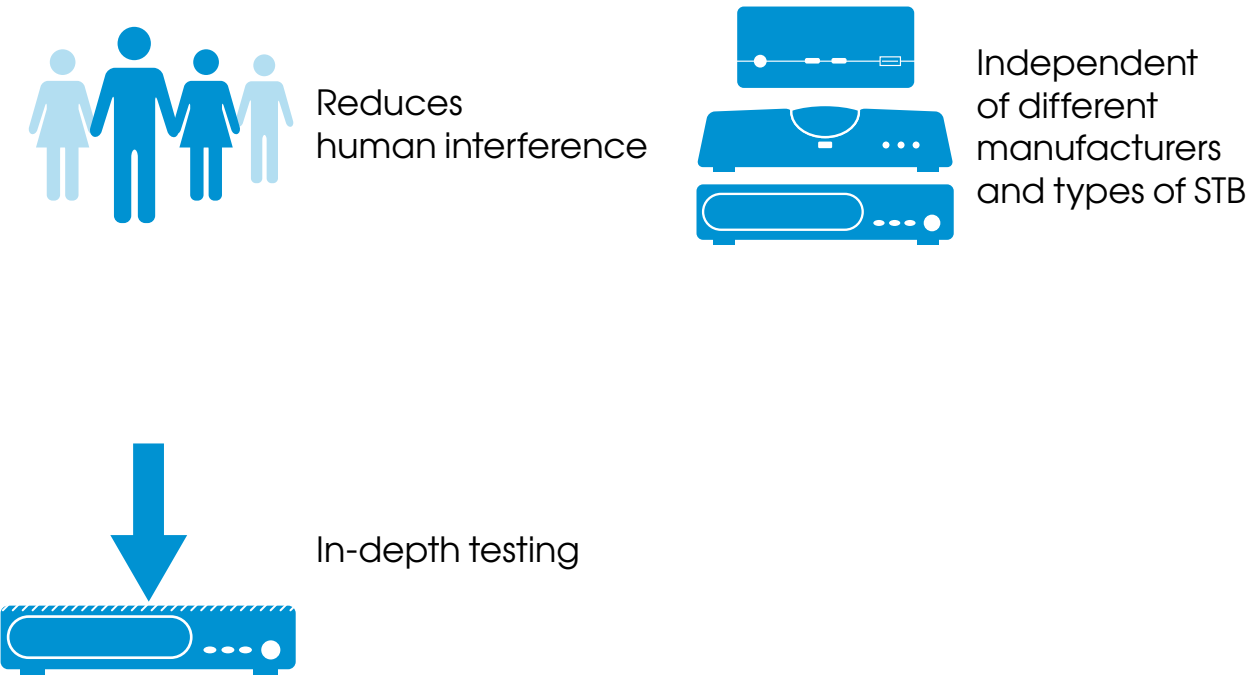
STB Diagnostic Station is intended for rapid testing and verification of devices intended for repair and returned from exploitation, from the standpoint of functionality. Set of developed tests is optimized and fast to execute, covering the basic functionalities, and at the same time allowing simultaneous testing of multiple devices.



STB service centers

Thus STB Diagnostic Station finds its area of application at operators who deliver set-top-boxes, manufacturers, and service companies engaged in the repair.

How it improves your productivity?



How does it work?

Testing of STB using Diagnostic Station assumes that audio and video interfaces of the tested device are electrically correct. The system records output audio and video content, and based on their comparison with referent content, by using various algorithms, decides whether the tested condition is correct or not.

The system is set up in the way that the outputs from the STB to be tested are fed to the grabber device's (RT-AV100) inputs. RC emulators are positioned in front of each device under test, enabling navigation through their menus. When the application is started on the PC workstation, it automatically loads the configuration, and controls the system and all connected devices.



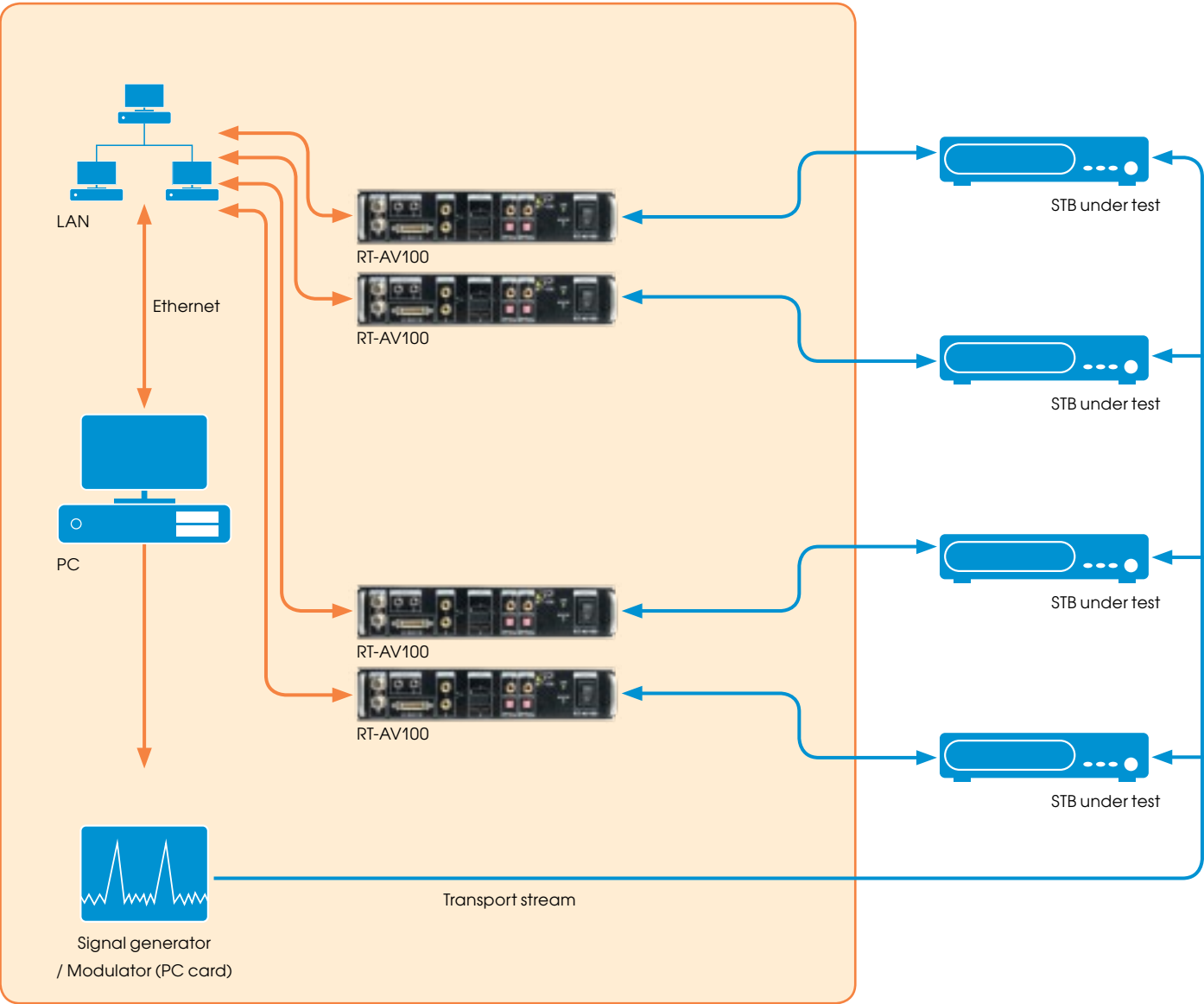
What is tested?

A pre-defined set of tests* running on STB Diagnostic Station cover following aspects:

- Reading the voltage levels on LNB and analog audio and video interfaces (CVBS and SCART)
- Decoding of compressed channels (MPEG4, MPEG2 ..) on the internal network (internal cable network)
- Testing of audio and video content for analog (CVBS, SCART, RGB) and digital (HDMI, S/PDIF Coax and Optical) interfaces with static or live video stream
- Testing in "loop through" conditions
- Testing of USB functionality
- ...

*The set of tests can be expanded in accordance with requirements of testing.

How to build the environment?



Most commonly detected errors

The most commonly reported errors are:

- Incorrect voltage values at SCART pin 8 and 16 - voltages which are related to aspect ratio selection and to RGB / CVBS selection, respectively
- Bad decoding of audio and video signals
- External media storage / shared content playback error

What am I buying?

STB Diagnostic Station consists of:

- HW* - 19" rack with:
 - 12 RT-AV100 devices
 - 12 RC emulators
 - 4-button keyboard
 - LAN switch
- SW
 - INTENT+ application for management of requirements, tests, test plans, and reporting
 - RT-Executor Lite application for carrying out tests
- Test suite**

* The described system accommodates 12 STB units. System size is scalable, and fully configurable to meet customer's needs. The system comes fully assembled (completed cabling)

** Includes adjustments of the tests to client's STB



A STB device is assembled. Is everything still in place after the assembling? Is any of the component unsoldered? Have the screws made somewhere short circuits? Answers to these and similar questions can be obtained by using of STB testing on the production line. It is a complete test environment that combines both hardware and software, as well as test scenarios that are easily adaptable to different types of STB (manufacturer, tuner types, etc.).



To whom is it intended?

Production line test suite, as its name implies, is designed for STB manufacturers (OEM). For this target group this environment for automatic verification of digital receivers is ideal because of its efficiency; primarily considering costs, as it does not require any additional investments in hardware and software. For its physical characteristics, the system is easily implemented in the infrastructure of the assembling line. Last but not least, the advantage of using such a system is a predefined set of tests that verifies the product after assembling in approximately 90 seconds.



How it improves your productivity?



Reduces human interference



Independent of different manufacturers and types of STB



Increases reliability of tested devices

How does it work?

The system for STB testing on the production line is composed of four independent test stations. Each station performs a specific set of tests, achieving optimality in their execution. The stations are:

Test Station 1 - AV analog interfaces

Intended for testing of analog audio (SCART, Line In) and video (CVBS, RGB) interfaces. It also checks quality of MPEG stream decoding.

Test Station 2 - LNB polarization and loop-through testing

Checks the LNB polarization (LNB voltage measurement, LNB sine tone and frequency) and performs loop-through measurements

Test Station 3 - HD AV and RF loop-through testing

Intended for testing of digital audio (HDMI, S / PDIF) and video (DVI) interfaces. It also verifies quality of the RF signal in loop-through mode.

Test Station 4 - Voltage Measurement

Intended for voltage measurements at SCART interface (pins 8 and 16), and power levels of the analog audio and video interfaces.

Most commonly detected errors

- Poor quality image at different loads (impedance) of CVBS/RGB
- Poor quality of audio in LNB loop-through mode
- Wrong voltage measured at SCART interface (pins 8 and 16)
- Wrong video power levels measured at different loads of CVBS/ RGB

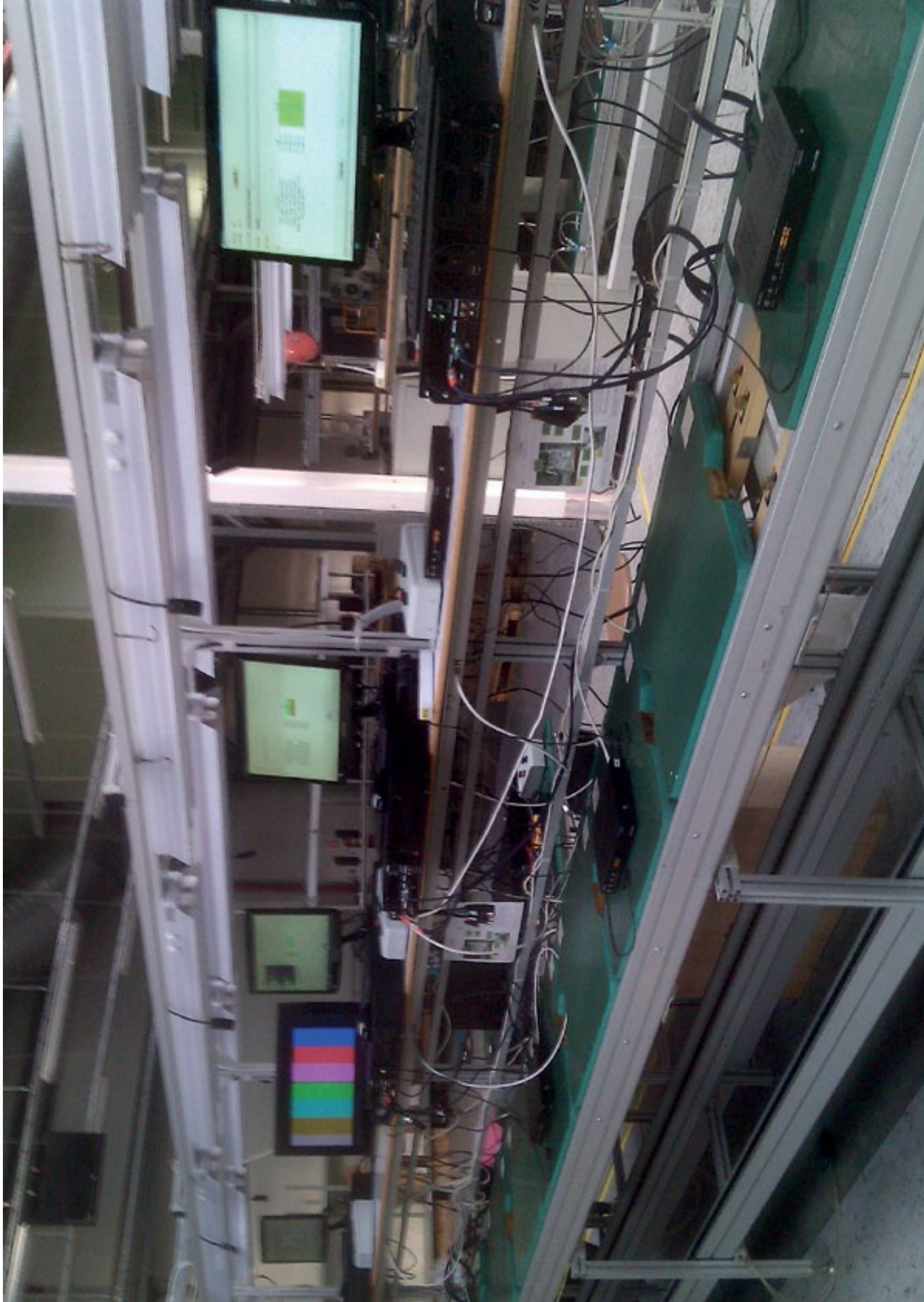
What am I buying?

The system for STB testing on the production line consists of:

- HW *
 - 4 RT-AV110 devices for recording of audio and video content
 - 4 button keyboard – test run interface
- SW
 - INTENT+ application for management of requirements, tests, test plans, and reporting
 - RT-Executor Lite application for carrying out tests
- Test suite ** - set of 27 tests.

* Displayed system with 4 test stations is fully configurable upon customers' requirements

** Includes client-ready tests (the tests being adjusted to a client's STB)



Complexity of TV system architecture increases rapidly with variety of input and output interfaces, multi-formats, with support of different picture sizes and frame rates. In addition, present TV systems support various operational modes: PiP, PaP, PaT. As a result, functional testing of digital TV systems has become more demanding task.

RT-TS-iDTV automated test suite offers is a complete solution for iDTV functional testing via LVDS interface.



To whom is it intended?

iDTV functional test suite is primarily intended for TV manufacturers and software suppliers. It is a market proven solution with Tier 1 IC vendors and OEM. The test suite performs complete spread-around functionality check of a TV set in thousands of tests organized in functional groups. It provides means to validate a product against various standards and requirements, and provides comprehensive reporting and database storage. By its performances it is considered to be an iDTV stress test.

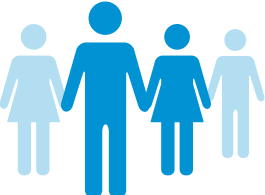


OEM

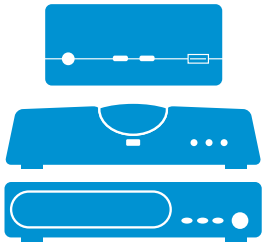


Software vendors


How it improves your productivity?




Reduces human interference



Independent of different manufacturers and types of STB



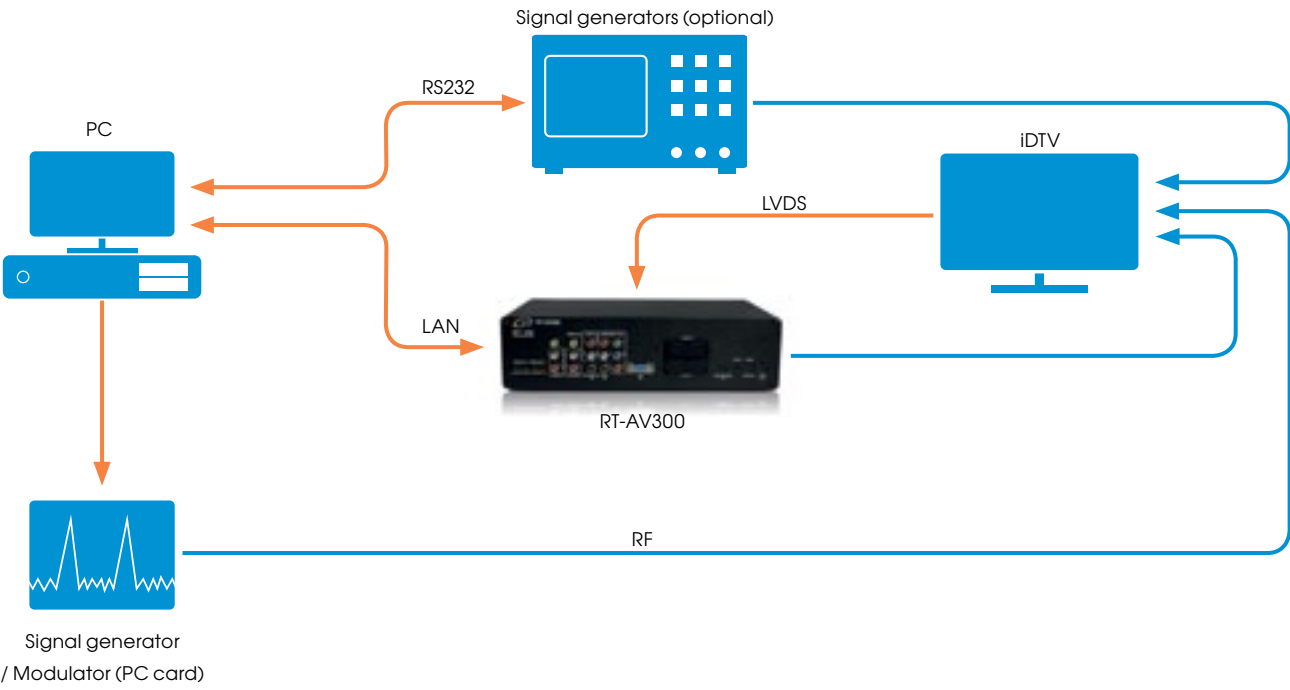
Accelerates time to market



Easily integrates 3rd party testing equipment

How to build the environment?

To build an environment - a pc with installed application for test management RT-Executor, RT-AV300 and RF feed is required. The system is 3rd party friendly supporting 80 devices (signal generators, modulators, power supplies) which can be included to complete the environment covering all input interfaces of a tested TV.



IDTV TEST SUMMARY	
Test Group/Case Description	
<01> Picture	1640
Test Set <1>: Picture Setting	480
Test Set <2>: Picture Preference	120
Test Set <3>: Picture Size	140
Test Set <4>: Blue Back	80
Test Set <5>: DNR	80
Test Set <6>: Reset	80
Test Set <7>: PC Setting	340
Test Set <8>: Warm Start (FLASH storing)	320
<02> Sound	580
Test Set <1>: NICAM	80
Test Set <2>: Bass Control	80
Test Set <3>: Treble Control	80
Test Set <4>: Balance Control	80
Test Set <5>: HDMI Audio	80
Test Set <6>: Digital Audio Output	80
Test Set <7>: Digital Audio Delay	60
Test Set <8>: Reset	20
Test Set <9>: Warm Start (FLASH storing)	20
<03> Channels	50
<ATV>	
Test Set <1>: Auto Channel Scan	3
Test Set <2>: Manual Channel Scan	2
Test Set <3>: Add/Skip Channels	4
Test Set <4>: Favorite Channels	3
Test Set <5>: Channel Labels	3
Test Set <6>: Clear Channel List	6
<DTV>	
Test Set <1>: Input Signal	5
Test Set <2>: Auto Channel Scan	3
Test Set <3>: Manual Channel Scan	2
Test Set <4>: Add/Skip Channels	4
Test Set <5>: Favorite Channels	3
Test Set <6>: Channel Labels	3
Test Set <7>: EPG	3
Test Set <8>: Clear Channel List	6

IDTV TEST SUMMARY	
<04> Settings	10
Test Set <1>: First time installation	1
Test Set <2>: Blue Background	3
Test Set <3>: AV Color	3
Test Set <4>: Auto Shut Off	3
<05> Source Testing	212
Test Set <1>: Automatic Source Detection (SCART)	8
Test Set <2>: SCART Output (ATV, DTV,Composite and SCART)	10
Test Set <3>: Supported Resolutions and Timings (VGA, SCART, HDMI, Composite	154
Test Set <4>: Source List Check (Menu, RC)	40
Test Set <5>: EU_AV_Input (CVBS, S-Video)	18
<06> ATV Tuning	466
Test Set <1>: Manual Tuning (PAL B/G, SECAM L)	230
Test Set <2>: Auto Tuning (PAL B/G, SECAM L)	230
Test Set <3>: Channel naming	2
Test Set <4>: Tuning with no Sound Standard (PAL B/G, SECAM L)	4
<07> Multimedia	20
Test Set <1>:USB Recognition	4
Test Set <2>:JPEG viewer	9
Test Set <3>:MP3 Songs	7
<08> DVB Tuning	381
Test Set <1>: DVB-C Scan Dialog (default setting)	27
Test Set <2>: DVB-C Manual Tuning (typical channels, 8kHz)	58
Test Set <3>: DVB-C Auto Tuning (Quick and Full scan for typical 8kHz channels)	116
Test Set <4>: DVB-T Scan Dialog (default setting)	6
Test Set <5>: DVB-T Manual Tuning (CH05-CH12, CH21-CH69)	57
Test Set <6>: DVB-T Automatic Channel Scan (CH05-CH12, CH21-CH69)	57
Test Set <7>: DVB-T System in 7MHz channels (QPSK,QAM16,QAM64)	60

IDTV TEST SUMMARY	
<09> DVB Audio Streaming	10
Test Set <1>: DVB-C audio supported (MPEG1, AAC, HEAAC, AC3, EAC3)	5
Test Set <2>: DVB-T audio supported (MPEG1, AAC, HEAAC, AC3, EAC3)	5
<10> DVB Video Streaming	30
Test Set <1>: DVB-C supported streams (codec, resolution)	15
Test Set <2>: DVB-T supported streams (codec, resolution)	15
<11> Teletext (ATV, DVB-T, DVB-C)	37
Test Set <1>: ATV Teletext On/Off	6
Test Set <2>: ATV Teletext Page number	1
Test Set <3>: ATV Subpage Mode Functionality	3
Test Set <4>: ATV Mixed Mode On/Off	1
Test Set <5>: ATV Shortcuts	4
Test Set <6>: DVB-C TXT Functionality	11
Test Set <7>: DVB-T TXT Functionality	11
<12> Language Settings	12
Test Set <1>: Menu - Settings - OSD	3
Test Set <2>: Audio - Settings - OSD	3
Test Set <3>: Subtitle - Settings - OSD	3
Test Set <4>: Digital Service - Settings - OSD	3
<13> Parental Settings	12
Test Set <1>: PIN	3
Test Set <2>: Maturity Lock	3
Test Set <3>: Child Lock	3
Test Set <4>: Set PIN	3
<14> Timer Settings	6
Test Set <1> Sleep Timer	3
Test Set <2> Sleep Timer while doing ATS	2
Test Set <3> Set Current Time	1
<15> Power Management	15
Test Set <1>: Switch from Power Off to Standby Mode	1
Test Set <2>: Switch from stand by to power on mode	10
Test Set <3>: Switch from power off to power on mode	2
Test Set <4>: Power Management System Reliability	2

IDTV TEST SUMMARY	
<16> EPG - Electronic Program Guide	9
Test Set <1>: Functionality test	9
<17> Miscellaneous Settings	3
Test Set <1>: Settings - Software update	1
Test Set <2>: Settings - Common interface	1
Test Set <3>: Front Panel	1
<18> CI - Common Interface	1
Test Set <1>: No CI inserted	1
Test Set <2>: CI specific tests	0

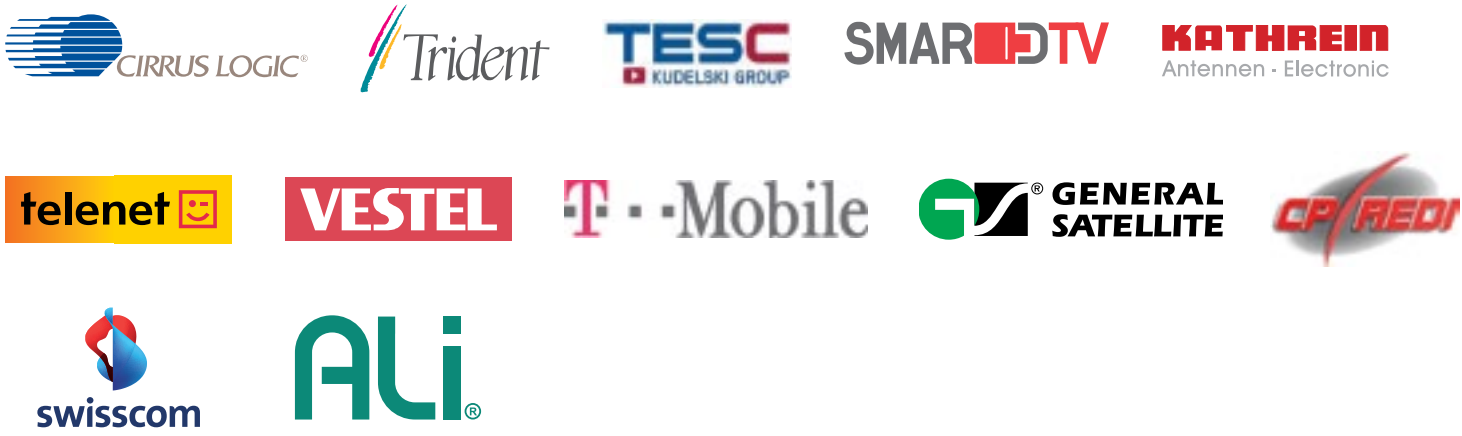
What am I buying?

IDTV functional test suite consists of ::

- HW *
 - RT-AV300 generator/grabber device for recording of audio and video content
- SW
 - RT-Executor application for test management and execution
 - Supported device drivers
- Test suite - set of 1500+ tests.



REFERENCES



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